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R. E. Arden.

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His Royal Highness The Duke of Sussex.
K. G. &c. &c.
President of the Society
for the Encouragement of Arts Manufactures & Commerce.

Engraved by C. Warren from a Painting by Harlow
in the possession of T. Savory, Esq.

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TRANSACTIONS

OF THE

Royal SOCIETY, of Arts

Instituted at London,

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES, AND COMMERCE;

WITH THE

PREMIUMS OFFERED IN THE YEAR 1819.

VOL. XXXVII.

LONDON:

SOLD BY THE HOUSEKEEPER, AT THE SOCIETY'S HOUSE IN THE ADELPHI;

AND BY ALL BOOKSELLERS.

MDCCCXX.

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Printed by T. C. Hansard, Peterborough-court, Fleet-street, London.

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ARRANGEMENT

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PREFACE.

THE Society has not had the misfortune of losing, by death, in the course of the last year any of the superior Officers or Members particularly entitled to the gratitude of the Institution. An opportunity has hence arisen, of which the Society has gladly availed itself, of prefixing to this Volume the Portrait of our President, his Royal Highness the Duke of Sussex, in testimony of respect from the Members at large. The accuracy and happiness of the likeness no one, probably, will call in question, and the style of the execution is such as might naturally be expected from the well-known talents of the artist employed.

The present Volume contains, as usual, those Communications on account of which the Society has, during the last Session, bestowed their honorary and pecuniary Rewards. To this list, however, must be added, in order to complete the entire

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number of medals conferred, those which have been voted for proficiency in the Arts of Design and of Engraving, and in other branches of Fine Art, which neither require nor admit of verbal description, and are, therefore, only recorded in the general list of rewards bestowed.

The object of the Society in the early and enlightened liberality with which they fostered the most important of the practical arts, Agriculture, has, for the most part, been accomplished. By the Premiums offered, and the Rewards bestowed from the very commencement of the Society, the landholders, and others engaged in agricultural pursuits, have acquired not only a list of desiderata, but also those improved methods of practice which have successively received the approbation of the Society. Nor is it unjust to suppose that the unexampled rapidity with which the art of cultivation has advanced to its present state, is in no small degree owing to the protection originally conferred by this Institution. But though we are well content that the local agricultural Societies of late established, should, each within its own district, exercise that special encouragement which it is not

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possible for us to confer, we still, however, reserve to ourselves and exercise with peculiar satisfaction, the bestowal of honorary Medals on those gentlemen, who, not unmindful of the benefits derived by themselves from their paternal woods, are desirous of transmitting equal obligations to their posterity. The Gold and the Silver Medals for planting Forest Trees have each been claimed during the last Session, the former by Dr. Thackeray, and the latter by R. Creyke, Esq.; besides which, the Society has thought proper, in consequence of the extent and success of the plantations made on part of Windsor Forest, by F. Palmer, Esq., to present that gentleman with their Silver Ceres Medal. Mr. Young's method of cultivating the Poppy in the neighbourhood of Edinburgh, and of obtaining opium from it of the very best quality, without exposing the juice during its consolidation to the fickleness of our climate, will, no doubt, be regarded as a communication of much moment in this department. Mr. Beckway's machine for Weighing and Binding Hay the Society considers as likely to be of great advantage to the growers of this commodity for the supply of the metropolis, by enabling them, to the mutual satisfaction of both

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buyer and seller, to weigh, with precision, every truss before it is bound, and yet to accomplish more work than can be got through in the usual inaccurate way of performing it.

In the class of Chemistry, the only Reward conferred has been on Mr. Cook, of the Royal College of Surgeons, for the signal success with which he has been able to preserve Anatomical Preparations by the use of brine alone; by which, not only the heavy expense hitherto incurred in spirit of wine will be saved to the professional anatomist, but the naturalist, and especially the scientific traveller will thus be enabled to retain many interesting specimens which their magnitude alone has hitherto precluded from the attempt to preserve.

In the class of Polite Arts, it will be found from the communications of Mr. Hulmandell and Mr. Redman, that the Society has not neglected the recent art of Lithography, by which identic copies of writing and drawing may be obtained, so as, in certain cases, to supersede the employment of the printing-press and the graver.

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In the same class Mr. Einsle's Ivory Paper has been liberally rewarded, as offering the best substitute for real ivory, with the additional advantages of superior size, greater cheapness, freedom from oiliness, and permanence of colour.

The communications in the class of Mechanics compose, as usual, a long and very miscellaneous list, varying in value, though in no instance, we trust, destitute of merit.

Two officers in the Navy, Lieuts. Rodger and Cook, have been very laudably employing themselves in investigating the best methods of constructing Rafts for the purpose of preserving the lives of seamen and others, in the event of their ship being lost. The means proposed by each are simple and effectual, and the Society, by the Rewards which they have bestowed, have shown how highly they esteem both the object and its accomplishment.

Mr. Monk's improvements in the construction of Gunpowder-mills, and Mr. Phillips's Coach-axles whereby the danger of accidents affecting life and limb is to a certain degree obviated, have also received the full approbation of the Society.

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Mr. Hardy's Inverted Spring Pendulum for rendering visible almost infinitely small quantities of motion, and thus ascertaining the stability of points of suspension for delicate pendulums, has obtained the lesser Gold Medal. Whether we employ the seconds' pendulum as the modulus of an universal system of weights and measures, or as a means of indicating the latitude, it is absolutely necessary to determine its length with the most rigorous exactness; but this cannot be done unless the center of suspension remains absolutely free from any vibratory motion impressed on it, and the instrument invented by Mr. Hardy is incomparably the best of any that has hitherto been devised for this purpose.

The very compact and portable Counting-machine invented by Mr. Donkin will be found a most useful instrument in the hands of the civil engineer, for registering repetitions of alternate or continuous motions, such as the strokes of a piston, or the revolutions of a wheel. And the Repeating Alarum adapted to the use of the practical astronomer by Mr. Taylor, of the Royal Observatory, will probably be considered as not among the least important of the contents of the present Volume.

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In the class of Colonies and Trade the sum of Fifty Guineas has been bestowed on Mr. Denovan, of Leith, for his success in curing British Herrings, so as to bring them in equal competition with the best Dutch herrings in the market of Hamburgh. The perseverance with which this gentleman has struggled successfully through a multitude of untoward events, and the liberality with which he has communicated his most successful processes to those engaged in the same pursuits, command the unqualified approbation of the Society.

Such are the principal communications which the Society of Arts has rewarded during the last Session, and which it now offers to the acceptance of that Public which is the ultimate judge and effectual encourager of all institutions, which, in their respective departments, are intended to promote the welfare and improvement of the community.

The Society take the present opportunity of returning their Thanks to the different Public Bodies and Individuals who have honoured them with Presents during the Session, the particulars

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of which are noticed in the body of the Volume. Without presuming to direct in what channels the liberality of the friends to this Institution shall flow, it may be stated, that such contributions as may put the Society in possession of a compleat collection of all the Publications of any value on the application of Mathematics to practical Mechanics, will be especially acceptable.

The Society desire it to be clearly understood, that, as a Body, they are not responsible for any Opinion or Representation of Facts contained in the following Pages.

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ERRATA IN VOLUME XXXV.

In the Description of Mr. DICK'S *Perspective Instrument.*

Page 92, *line* 4, *for* distinct ratio, *read* direct ratio.
7, *for* B C, *read* B E.
10, *for* *a b*, A B, *b d*, B D, and *c a*, C A, *read* *a b*, A B, *b c*, B C, *c d*, C D, and *d a*, D A.
24, *for* $\frac{1}{2}$ or unity, *read* 1 or unity.
25, *for* 2 : 1 : : 1 : 5, *read* 2 : 1 : : 1 : ·5.
—— 94, — 20, *for* world, *read* would.
—— 95, — 11, *for* objects, *read* digits.
—— 96, — 20, *for* dividend edge, *read* divided edge.
—— 97, — 27, *for* between the parallel, *read* between the parallels.
—— 99, — *last*, *for* F F, G H, *read* E F, G H.
—— 102, — 10, *for* K L of the picture, *read* K L the picture.
—— 103, — 8, *for* radical, *read* radial.
27, *for* distance on C, *read* distance on O P.
—— 104, — 1, *for* numbers, *read* number.
—— 105, — 29, *for* divide, *read* denote.
—— 107, — 3, *for* under 2, *read* under Q.
— 10, *for* vernier, *read* verniers.
— 17, *for* lines, *read* limbs.
—— 108, — 16, *for* square top L, *read* square top of L.
— 18, *for* outer, *read* under.
—— 109, — 5, 6, 7, *for* to put that which is next to the picture and is numbered 11 either upon the farthest or nearest point of sight, *read* to put that numbered 11 either upon the nearest point of the plan, or a little on the side of it next the point of sight.

And in the note to the table page 106, *for* drawing them no alteration to them, *read* drawing no attention to them.

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ERRATA in Volume XXXVI.

Page 5, *line* 5, *for* sitting, *read* setting.
—— 10, — 27, *for* 8½*d*. *read* 8½ tons.
—— 11, — 23, *for* 3 *read* 5.
—— 12, — 26, *for* 293, *read* 292.
—— 17, — 1, *for* 14, *read* 13.
5, *for* 6-6, *read* 5-6.
—— 28, *last line, for* raising the handle, *read* pulling the cord.
—— 68, *line* 15, *for b* ; fig. 1 plate II, *read b* fig. 1 plate II.
—— 69, *last line but one, for* bung, *read* bung-hole.
last line, for it, *read* the bung.
—— 70, *line* 13, *for* lashing ; *f g*, *read* lashing *f* ; *g*.
—— 96, — 1, *for* pl. VII, *read* pl. VI.
—— 97, — 14, *for* VI, *read* VII.
26, *for* fig. 10, *read* figs. 10, 11.
—— 112, — 12, *for* it, *read* the lever.
—— 119, — 24, *for* 3, 13, *read* 1, 4.
31, *for* brass, *read* brass *s s*.
—— 120, — 7, *for a*, *read* A.
—— 125, — 6, *for x*, *read c*.
7, *for* in figs., *read m* in figs
12, *for* in *r*, *read* in ; *r*.
—— 146, — 22, *for i e j*, *read i c j*.
—— 155, — 28, *for* N. E. *read* N. S.
—— 158, — 15, *for e*, *read w*.
—— 162, — 16, *for c c*, *read e c*.
—— 167, — 29, *for* xx, *read* xviii.
—— 171, — 3, *for* xiv, *read* xxvi.

PAPERS

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Premiums offered

IN THE SESSION 1819—1820.

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A LIST of the OFFICERS of the SOCIETY.

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DUKE OF SUSSEX, K. G. &c. &c.

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Collector, ... MR. HENRY HARRISON.

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ADVERTISEMENT TO THE PUBLIC.

THE chief object of the SOCIETY is, to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for all such useful Inventions, Discoveries, and Improvements (though not mentioned in these Premiums) as tend to that purpose; and, in pursuance of this plan, the Society have already expended upwards of EIGHTY-FIVE THOUSAND POUNDS, advanced by voluntary subscriptions of Members, and legacies bequeathed.

The Register of Premiums and Bounties which they have given, and which may be seen at the SOCIETY's house in the Adelphi, will show the very great advantages derived by the Public from this Institution.

The meetings of the SOCIETY are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The several Committees meet on other evenings in the week during the session, as particularly mentioned in their printed book of Rules and Orders.

In order still farther to promote the laudable Views of the SOCIETY, it may be necessary to explain the mode by which members are elected.

Each member has the privilege, at an ordinary meeting of the SOCIETY, or by letter to the Secretary, to propose any person who is desirous to become a Member; such proposal to contain the name, full addition, and place of abode, of the proposed Member, and to be signed by three members of the SOCIETY.

Peers of the Realm, or Lords of Parliament are, on their being proposed, immediately balloted for; the names of other persons proposed to become Members are read by the Secretary to the SOCIETY, and are then inserted in lists which are hung up in the SOCIETY's room; they are balloted for at the second following ordinary meeting. In both cases, if two-thirds of the members then voting, ballot in their favour, they are deemed Perpetual Members, upon payment of not less than Twenty Guineas in one sum, or Subscribing Members upon payment of any sum not less than Two Guineas annually.

All Members are entitled to vote and assist in all the business of the SOCIETY and of the several Committees. The Members have also the privilege of recommending two persons as visitors at the meetings of the SOCIETY; and, by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various Models, Machines, and Productions, in different branches of Arts, Manufactures and Commerce, for which rewards have been bestowed; also to inspect the magnificent series of Moral and Historical Paintings, executed by the late J. BARRY, Esq. which, with some valuable Busts, Statues, Portraits, &c. decorate the public rooms of the Society.

Members have the use of the SOCIETY's Library, which is valuable, and annually increasing by the purchase and donation of scientific and useful books, and of engravings. The SOCIETY are highly sensible of the great importance of such acquisitions, and are happy to record them, with the names of the donors, in the Volume annually published of the SOCIETY's Transactions, to which the Members are entitled.

Ladies are eligible, as Members of the Society, to all the Privileges thereof, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a Member, on his producing a written authority for the same.

The SOCIETY desire it to be clearly understood, that, as a Body, they are not responsible for any opinion or representation of facts contained in their Volumes. And the Public are requested to guard against impositions, from persons advertising as having Patents for Articles rewarded by the SOCIETY. It is a stipulated condition, that all Persons who receive Premiums or Bounties from the SOCIETY, shall

relinquish all pretensions to a Patent for Articles so rewarded, and shall allow them to be made or manufactured by any Person whatever.—The Public are also cautioned against purchasing Articles sold under a pretended sanction of the Society's Name.

The consideration of the Claims to the Premiums offered in the present List, will take place during the Session of the Society, commencing on Wednesday, the 5th of November 1819. The several Candidates and Claimants, to whom the Society shall adjudge Premiums or Bounties, are to attend on the last Tuesday in May, at eleven o'clock in the forenoon precisely, to receive the same, that Day being appointed by the Society for the Distribution of their Rewards; and before that time no Premium or Bounty will be delivered, except to those who are about to leave the Kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, Deputies may be substituted to receive the Rewards, provided such Deputies are either Members of the Society, or superior Officers thereof.

Since the last Distribution of Rewards, *Two Hundred and Five* New Members have been elected.

The Society have lately published, the 36th *Volume* of their Transactions, with a Supplement in Royal 8vo, containing the Report, &c. on Preventing Forgery of Bank Notes—to these all Members are entitled; and others may purchase them from the Housekeeper, price 10*s.* 6*d.* boards, for the Volume, and 4*s.* the Supplement. Also complete Sets of their Transactions, or any single Volume.

An *Analytical Index of the First Twenty-five Volumes* of the Transactions, to the termination of the Session, June, 1807, price 2*s.* 6*d.*

A List of the Machines and Models in the Society's Repository, to the year 1813, inclusive.

A Catalogue of Books in the Society's Library, 1*s.*

A Description of Mr. Barry's Paintings in the Great Room of the Society.

GENERAL CONDITIONS.

AS the great object of the Society in rewarding individuals is, to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large, Candidates are requested to observe, that if the means by which the respective objects are effected, require an expense or trouble too great for general purposes, the Society will not consider itself bound to give the offered reward; but, though it thus reserves the power of giving in all cases, such part only of any premium as the performance shall be adjudged to deserve, or of withholding the whole if there be no merit, yet the Candidates may be assured the Society will always judge liberally of their several claims.

All Candidates are to take notice, that no claim for a premium will be attended to, unless the conditions are fully complied with.

The models of all machines, which obtain premiums or bounties, shall be the property of the Society.—The Premiums are designed for the United Kingdom, unless expressly mentioned to the contrary.—The claims will be determined as soon as possible after the delivery of the specimens.—It is expected that all articles for claims or bounties be sent to the Society, carriage paid.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained or purposes to obtain, a patent, or for which he has obtained any premium or reward from any other Society.

A Candidate for a premium, or a person applying for a bounty, being detected in any disingenuous method to impose on the Society, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

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No member of this Society shall be a Candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medal of the Society. The Candidates are, in all cases, expected to furnish a particular account of the subject of their claims; and where certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in the words of the conditions attached to the respective premiums, and be signed by disinterested persons who have a positive knowledge of the facts stated.

Where premiums or bounties are obtained in consequence of specimens produced, the Society will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No Candidate, not a member, shall be present at any meeting of the Society or Committees, or admitted at the Society's rooms, after they have delivered in their claims, until such claims are adjudged, unless summoned by the Committee.

The Society, anxious to promote the Arts of their country, have adopted the resolution of forming a Collection of Prints, to be open for public inspection; and, having arranged those already in their possession, invite engravers to send etched or finished proofs of their plates; and hope that amateurs, collectors, and publishers of works of art, will also contribute to the undertaking.

Prints of Machines, or Maps, will also come within this arrangement.

This Society farther invite the communications of scientific and practical men, upon all subjects connected with the views of this Society, although their experiments may have been conducted upon a smaller scale than the terms required by the premiums; as such communications may afford ground for more extensive application, and thus materially contribute to the advantage of the public.

The Library of the Society, which has already become very valuable, may yet receive considerable additions and improvements from the presents of members, or other persons who may be inclined to place useful books or valuable manuscripts in a repository at once permanent and conducive to the national benefit.

All communications are to be made by letter, addressed to Arthur Aikin, Esq. the Secretary, at the Society of Arts, &c. Adelphi, London.

And where articles are sent by Sea for the Society, the Bills of Lading are to be addressed to the care of William Vaughan, Esq. Mincing-lane, London, who has undertaken to receive them for the Society.

The Winchester bushel is the measure referred to for grain; and, as the acres of different districts vary in extent, it is necessary to observe, that the Society mean Statute Acres of five and a half-yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.

The Society desire that the Papers on different subjects sent to them may be full, clear, and explicit, fit for publication; and that descriptive drawings may be sent, with the Models and Machines laid before the Society.

*** To persons inclined to leave a sum of money to this Society by Will, the following form is offered for that purpose.

Item.—I give and bequeath to A. B. and C. D. the sum of
upon condition and to the intent that they, or one of them, do pay the same to the Collector, for the time being, of a Society in London, who now call themselves the Society for the Encouragement of Arts, Manufactures, and Commerce; which said sum of I will and desire may be paid out of my personal estate, and applied towards the carrying on the laudable designs of the Society.

The Society take this opportunity of returning their thanks to the several Societies and Individuals who have favoured them with Presents for their Repository and Library.

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PREMIUMS IN AGRICULTURE.

THE Candidates for planting all kinds of Trees are to mention the nature of the Soil, to produce Certificates that the respective Plantations are properly fenced and secured, and particularly to state the condition of the Plants at the time of sending such Certificates. Any information which the Candidates for the following Premiums may choose to communicate, relative to the methods made use of in forming the Plantations, or promoting the growth of the several Trees, or any other observations that may have occurred on the subject, will be thankfully received.

It is the intention of the Society that such lands only as are not calculated for the purposes of husbandry, should be employed for the purposes specified in these Advertisements relative to Plantations.

ACORNS.

1. FOR having set, between the first of October, 1817, and the first of April, 1818, the greatest quantity of land, not less than ten acres, with Acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

2. For the second greatest quantity of land, not less than five acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young Oaks on each acre, to be delivered to the Society on or before the first Tuesday in February, 1820.

RAISING OAKS.

3. To the person who shall have raised, since the year 1815, the greatest number of Oaks, not fewer than five thousand, either from young plants or acorns, in order to secure a succession of oak timber in this kingdom;—*the Gold Medal.*

4. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates that there were on the land at least the number of young Oak Trees required, in a thriving condition, two years after the planting, with an account of the methods pursued in making and managing the plantation, to be produced to the Society on or before the first Tuesday in February, 1820.

THE BEST METHOD OF RAISING OAKS.

5. To the person who shall ascertain in the best manner by actual experiments, the comparative merits of the different modes of raising Oaks for timber, either from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on a smooth surface, or among bushes, fern, or other cover; or from young plants previously raised in nurseries, and transplanted; regard being had to the expense, growth, and other respective advantages of the several methods;—*the Gold Medal.*

The accounts and proper certificates that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in February, 1820.

ELM.

6. For having planted the greatest number of the English Elm, not less than eight thousand, between the 24th of June, 1817, and the 24th of June, 1818, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

7. For the second greatest number, not less than five thousand;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, that the plants were in a healthy and thriving

state two years at least after making the plantation, and specifying the distance of the plants, to be delivered to the Society on or before the first Tuesday in April, 1820.

LARCH.

8. For having planted out, between the 24th of June, 1816, and the 24th of June, 1817, the greatest number of Larch Trees, not fewer than five thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

9. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1820.

N. B. The Larch Trees may be planted either mixed with other trees, or by themselves, as may best suit the convenience of the planter.

ASH.

10. For having sown or set, in the year 1816, the greatest quantity of land, not less than six acres, with Ash for timber, with or without seeds, cuttings, or plants, of such other trees as are adapted to the soil;—*the Gold Medal.*

11. For the next greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of the sowing or setting, agreeably to the above conditions, that there are not fewer than six hundred Ash Plants on each acre, in a thriving and healthy condition, two years at least after the sowing or setting, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1820.

FOREST TREES.

12. To the person who shall have enclosed and planted, or set, the greatest number of acres (not less than ten) of land that is incapable of being ploughed, such as the borders of rivers, the sides of precipices, and any land that has too many rocks, or that is not calculated to repay the expense of tillage, owing to the surface being too hilly, mountainous, or otherwise unfit for tillage, with the best sorts of Forest Trees, namely, oak, Spanish chesnuts, ash, elm, beech, alder, willow, larch, spruce, or silver fir (with or without screens of Scotch fir) adapted to the soil, and intended for timber trees, between the first of Oct. 1816, and the first of April 1817;—*the Gold Medal.*

13. For the second greatest quantity of land; not less than seven acres;—*the Silver Medal.*

A particular account of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after making the plantations, to be delivered to the Society on or before the second Tuesday in February, 1820.

N. B. With the above Forest Trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

NORWAY FIR SEEDLINGS.

14. To the person who shall have planted in the united kingdom, during the year 1817, the greatest number, not less than two thousand, of red wood and white wood Norway Fir Seedlings, at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the first Tuesday in February, 1820.

N. B. It is recommended to plant the seedlings of about three or four years growth, and in a moderately good soil, somewhat sheltered; the wood from the district of Christiana is esteemed the best for carpenters' and joiners' use: and for spars and upers the trees near to Long Sound are most valued.

CHESNUTS.

15. For having sown or set between the 1st of October, 1817, and the 1st of

April, 1818, the greatest quantity of land, not less than six acres, with Spanish Chesnuts, with or without seeds, cuttings, or plants of other trees, adapted to such soil, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

16. For the second greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of sowing or setting, agreeably to the above conditions, and that there are not fewer than three hundred Chesnut Plants in a thriving state, on each acre, to be delivered to the Society on or before the first Tuesday in February, 1820.

WALNUT TREES.

17. For having planted the greatest number of Walnut Trees, not less than five hundred, between the 24th of June, 1817, and the 24th of June, 1818, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

18. For the next greatest number, not fewer than three hundred;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantations, and specifying the distance of the plants from each other, to be delivered to the Society on or before the first Tuesday in April, 1820.

WALNUTS.

19. To the person who shall invent and discover to the Society an improved mode of propagating the superior varieties of Walnuts, either by budding, grafting, or any other mode, except sowing;—*the Gold Medal.*

Certificates that not less than fifty trees have been so raised; with a full account of the method practised, to be produced to the Society on or before the first Tuesday in April, 1820.

SECURING PLANTATIONS.

20. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive, method of securing young plantations of timber trees and hedge rows, from hares and rabbits, as well as from sheep and cattle, which at the same time shall be least subject to the depredations of wood-stealers;—*the Silver Medal.*

The accounts, and certificates of the efficacy of the method to be produced to the Society on or before the last Tuesday in March, 1820.

WHEAT.

21. For the best set of experiments made on not less than twelve acres, four of which to be sown broad-cast, four drilled, and four dibbled, the two latter in equi-distant rows, in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation and expense of each mode of culture be fully described; and that proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the last Tuesday in February, 1820.

BEANS.

22. To the person who shall discover and cultivate, either by the drill or dibbling method, on not less than five acres, a species of Horse-beans or Tick-beans, that will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the last Tuesday in February, 1820. It is apprehended that if a Bean should be brought into cultivation with the habits of hotspur, or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat.

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PARSNIPS.

23. To the person who shall cultivate the greatest quantity of land, not less than five acres, with Parsnips, for the particular purpose of feeding cattle or sheep ;—*the Gold Medal.*

Certificates of the quantity of land so cultivated, with a particular account of the nature of the soil and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the Parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the last Tuesday in February, 1820.

BUCK WHEAT.

24. To the person who shall cultivate the greatest quantity of land with Buck Wheat, not less than thirty acres ;—*the Gold Medal.*

It is required that the time of sowing and reaping be noticed; also a particular account of the species, and mode of cultivation, the manner of reaping, thrashing, and housing it, and the expense attending the same, with proper certificates of the nature and condition of the land on which the experiments were made, and the name of the crop, if any, which the same land bore the preceding year, together with an account of the produce, and a sample of the seed, not less than a quart, be produced to the society on or before the last Tuesday in February, 1820.

25. For the next greatest quantity, not less than fifteen acres, on similar conditions;—*the Silver Medal.*

Information respecting its application to the feeding of cattle, hogs, and poultry, and other of its uses, is also desired. It is known to be particularly serviceable in furnishing honey to bees.

GRASS SEEDS.

26. To the person who shall raise the greatest quantity of each or any of the following named grass seeds, viz.—Meadow Fox-tail (alopecurus pratensis), Sweet-scented Vernal-grass (anthoxanthum odoratum). Timothy-grass (phleum pratense), Meadow Fescue-grass (festuca pratensis), smooth-stalked Meadow-grass (poa pratensis), rough-stalked Meadow-grass (poa trivialis); rough Cock's-foot (dactylis glomerata) perennial Ray-grass (lollium perenne) ;—*the Silver Medal.*

It is required that certificates from persons who have viewed them in a proper state to identify that they are one or other of the seeds above-mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first day of March, 1820.

HEMP.

27. The Society, wishing to encourage the growth of Hemp, in every part of the united empire, for the use of the navy, offer to the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the greatest quantity of land in any part of the united empire, not less than fifty acres statute measure in the year 1819, and shall have at the proper season caused to be plucked the summer Hemp (or male Hemp bearing no seed), and continue the winter hemp (or female Hemp bearing seed) on the ground until the seed is ripe :—*the Gold Medal.*

28. To the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the next greatest quantity of land in any part of the united empire, not less than twenty-five acres, statute measure, in the year 1819, and shall at the proper season cause the same to be plucked as above-mentioned ;—*the Silver Medal.*

Certificates of the number of acres, of the distance of the drills, of the plucking of the Hemp, with a general account of the soil, cultivation, and produce, to be delivered to the Society along with fourteen pounds of the Hemp and two quarts of the seed, on or before the last Tuesday in February, 1820.

N. B. The two preceding premiums are continued for one year longer on the same conditions.

POTATOES.

29. To the person who shall, in the year 1820, cultivate the greatest quantity of land, not less than fifty acres, with Potatoes of such qualities as

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shall be fit for the use of the table in the months of April, May, and June, 1821;—*the Gold Medal*, or *Thirty Guineas*.

Proper certificates, along with other necessary particulars, to be delivered in to the Society on or before the first Tuesday in Nov. 1821.

PRESERVING TURNIPS, CARROTS, PARSNIPS, BEETS, OR MANGEL WORZEL.

30. To the person who shall discover to the Society the best and cheapest method of preserving these roots perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal*.

It is required that a full and accurate account of the method employed, and the expense attending the process, together with certificates that the produce of four acres, at the least has been preserved according to the method described, and applied to the feeding of sheep and neat cattle; that the whole were drawn out of the ground before the first day of February, in order to clear the greater part of it previous to its being prepared for corn, and to save the soil from being exhausted by the turnips or other roots, and also of the weight of an average sixteen perches of the crop; be produced to the Society on or before the last Tuesday in April, 1820.

31. For the next in quantity and merit, on not less than two acres;—*the Silver Medal*.

PRESERVING CABBAGES.

32. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed Cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal*.

33. For the next in quantity and merit, on not less than two acres;—*the Silver Medal*.

Conditions the same as for preserving turnips, Art. 30.—And the accounts to be produced on or before the last Tuesday in April, 1820.

MAKING MEADOW-HAY IN WET WEATHER.

34. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of making Meadow-hay in wet weather;—*the Gold Medal*.

A full account of the method employed, and of the expense attending the process, with not less than fifty-six pounds of the Hay; and certificates that at least the produce of six acres of land has been made according to the method described, and that the whole is of equal quality with the sample; to be produced on or before the first Tuesday in February, 1820.

HARVESTING CORN IN WET WEATHER.

35. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of Harvesting Corn in Wet Weather;—*the Gold Medal*.

A full account of the method employed, and of the expense attending the process, with not less than two sheaves of the Corn, and certificates that at the least the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples; to be produced on or before the first Tuesday in February, 1820.

GAINING LAND FROM THE SEA.

36. To the person who shall have gained the greatest quantity of Land from the Sea, not less than fifty acres, on the coast of Great Britain or Ireland;—*the Gold Medal*.

Certificates of the quantity of Land, and that the experiments were begun after the first of January, 1814, to be produced to the Society on or before the first Tuesday in February, 1820.

37. The same premium is extended one year farther.

IMPROVING WASTE LAND.

38. For the most satisfactory account of the best method of improving any one of the following soils, being Land lying Waste and Uncultivated, viz. clay, gravel, sand, chalk, peat earth, or bog, verified by experiments on not less than fifty acres of land;—*the Gold Medal*.

39. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required, that the Land, before such improvement, be absolutely uncultivated, and in a great measure useless, and that, in its improved state, it be enclosed and cultivated.

Certificates of the number of acres, of the quality of the Land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced on or before the first Tuesday in February, 1820.

SPADE HUSBANDRY.

40. For the best set of experiments, made on not less than eight acres of land, four of them to be cultivated by the ordinary mode, and four by the Spade; for the purpose of ascertaining the comparative advantages of the plough and Spade culture as applied to any one of the following crops; viz. flax, lucern, carrots, parsnips, mangel worzel or turnips;—*the Gold Medal,* or *Thirty Guineas.*

It is required that each mode of culture be fully described and that proper certificates of the nature and condition of the Land on which the experiments are made, together with the expense attending each mode, as also of the produce of each, be sent to the Society on or before the first Tuesday in February, 1820.

MANURES.

41. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following Manures, used as top-dressings on grass and corn land, viz. soot, coal-ashes, wood-ashes, lime, gypsum, bones, night-soil, or any other fit article;—*the Gold Medal.*

It is required that the above experiments, be made between two or more of the above-mentioned Manures, and that not less than two acres of land be dressed with each Manure.

An account of the nature of the soil, quantity, and expense of the manure and crops, with certificates, to be produced on or before the last Tuesday in February, 1820.

IRRIGATION OF LAND.

42. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land superior to, and cheaper than any other method now in use;—*the Gold Medal,* or *Fifty Guineas.*

A model, on a scale of one inch to a foot, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it was raised, to be produced to the Society on or before the first of March, 1820.

PARING PLOUGH.

43. To the person who shall invent and produce to the Society a machine or Plough for the purpose of Paring land preparatory to burning, superior to any hitherto known or in use for such purpose, and to be worked by not more than one man and two horses;—*the Silver Medal,* or *Twenty Guineas.*

The machine and certificates that at least ten acres have been pared by it in a proper manner, to be produced to the Society on or before the first of February, 1820.

DIBBLING MACHINE.

44. To the person who shall invent a machine, superior to any hitherto known or in use, to answer the purpose of dibbling wheat, by which the holes for receiving the grain may be made at equal distances and proper depths; *the Silver Medal* and *Ten Guineas.*

The Machine with certificates that at least three acres have been dibbled by it, to be produced to the Society on or before the second Tuesday in February, 1820.

MACHINE FOR REAPING OR MOWING CORN.

45. For inventing a machine to answer the purpose of Mowing or Reaping wheat, rye, barley, oats or beans, by which it may be done more expeditiously and cheaper than by any method now practised, provided it does not shed the Corn or Pulse more than the methods in common practice, and that it lays the straw in a proper manner for binding;—*the Gold Medal.*

The machine, with certificates that at least three acres have been cut by it, to be produced to the Society on or

before the second Tuesday in January, 1820. Simplicity and cheapness in the construction of this and the preceding Machine will be considered as principal parts of their merit.

THRASHING MACHINE.

46. To the person who shall invent a Machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at a less expense, than by any method now in use;—*the Gold Medal.*

The Machine, or a Model, with proper certificates that such a Machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation, to be produced to the Society on or before the last Tuesday in February, 1820.

DESTROYING THE GRUB OF THE COCKCHAFER.

47. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying the Grub of the Cockchafer, or of preventing or checking the destructive effects which always result from the attack of these insects on corn, peas, beans, and turnips;—*the Gold Medal.*

The accounts, with proper certificates, to be produced on or before the first Tuesday in February, 1820.

DESTROYING WORMS.

48. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying worms, or of preventing the destructive effects they occasion on corn, beans, peas, or other pulse;—*the Silver Medal.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in February, 1820.

DESTROYING THE FLY ON HOPS.

49. To the person who shall discover to the Society an easy and efficacious method of destroying the Fly on Hops, superior to any hitherto known;—*the Gold Medal.*

Accounts and certificates of the method having been successfully practised on not less than four acres of Hop ground; to be delivered to the Society on or before the first Tuesday in February, 1820.

PREVENTING THE BLIGHT ON FRUIT TREES AND CULINARY PLANTS.

50. To the person who shall discover to the Society the most effectual method of preventing the Blight or Ravages of Insects, on Fruit Trees and Culinary Plants, superior to any hitherto known or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

The accounts, with proper certificates, to be delivered to the Society on or before the last Tuesday in February, 1820.

FOR SCRAPING THE BARK OF FRUIT TREES.

51. To the person who shall send to the Society the best account of experiments made by scraping the bark of Fruit Trees, according to the plan recommended by Sir John Sinclair, in his Treatise on the subject;—*the Silver Medal.*

Certificates that the experiments have succeeded, to be sent to the Society on or before the first Tuesday in March, 1820.

CURE OF THE ROT IN SHEEP.

52. To the person who shall discover to the Society the best and most effectual method of curing the Rot in Sheep, verified by repeated and satisfactory experiments;—*the Gold Medal.*

It is expected that the Candidates furnish accurate accounts of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper certificates, must be delivered to the Society on or before the last Tuesday in February, 1820.

CURE OF THE FOOT-ROT IN SHEEP.

53. To the person who shall discover to the Society the best and most effectual method of curing the Foot-Rot in sheep;—*the Silver Medal.*

It is required that the cure be ascertained by repeated and satisfactory experiments, and the method of performing it be verified by proper certificates, delivered to the Society on or before the last Tuesday in February, 1820.

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PREVENTING THE ILL EFFECTS OF FLIES ON SHEEP.

54. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies;—*the Silver Medal.*

It is required that the method be ascertained by repeated experiments, and that a certificate of its efficacy be delivered to the Society on or before the first Tuesday in February, 1820.

PROTECTING SHEEP.

55. To the person who, in the winter 1819, 1820, shall have protected the greatest number of sheep, not fewer than one hundred, by hovels, sheds, or any other means;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society on or before the first Tuesday in March, 1820.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time; together with the general method of managing them.

FEEDING CATTLE.

56. For the best experiments on Stall feeding of Cattle (not less than five head), to be continued for the space of twelve months, in order to prove the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain, or Ireland, specifying the nature of the food given, together with the daily consumption of each beast, with its weekly increase in weight, and such other observations as may be deemed of consequence;——*the Gold Medal.*

A full account of the methods employed, and of the expenses attending the same, and certificates of the sundry matters stated, to be produced on or before the second Tuesday in Feb. 1820.

BEES, WAX, AND HONEY.

57. To the person who shall erect, previous to the first day of September, 1819, an apiary, containing the greatest number of hives or boxes stocked with Bees, not less than one hundred;—*the Silver Medal,* or *Twenty Guineas.*

58. For the next greatest number, not fewer than fifty stocks:—*Ten Guineas.*

Proper certificates of the number of stocks, and that they have been in the possession of the claimant during the preceding summer, to be produced to the Society on or before the first Tuesday in March, 1820.

It is expected that the claimant will give such particular information on the subject, as may tend to benefit the public, and enable other persons to keep bees to advantage; also that improved methods be made use of in their management.

PREMIUMS

FOR DISCOVERIES AND IMPROVEMENTS IN

CHEMISTRY, DYEING, AND MINERALOGY.

INCREASING STEAM.

59. To the person who shall invent and discover to the Society a method, verified by actual experiments, of increasing the quantity or force of Steam in Steam Engines, with less fuel than has hitherto been employed, provided that in general the whole amount of the expenses in using steam engines may be considerably lessened;—*the Gold Medal* or *Fifty Guineas.*

To be communicated to the Society on or before the last Tuesday in February 1820.

PREVENTION OF SMOKE.

60. To the person who shall invent and produce to the Society the best and easiest means, superior to any now before the public, of preventing the emission of dense Smoke from the chimnies of steam-engines, breweries, and ma-

nufactories;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the means proposed have been found to succeed in practice, to be produced to the Society on or before the first Tuesday in February, 1820.

COAL GAS.

61. To the person who shall discover the cheapest method of purifying the inflammable gas procured from coal, superior to any method now in use;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, with certificates of its fully answering the intended purpose, to be produced to the Society on or before the second Tuesday in February, 1820.

PREVENTING THE ILL EFFECTS OF SMELTING ORES.

62. To the person or persons who shall invent and discover to the Society the most effectual method or methods of preventing the ill effects arising to vegetation and animal life, from the sulphureous, arsenical, or other noxious fumes disengaged in smelting the ores of Copper, Zinc, Lead, Tin, Iron, &c. in the large way, and if possible, of converting those pernicious fumes to useful purposes, in a manner superior to any hitherto known or in use;—*the Gold Medal*, or *Fifty Guineas.*

It is required that a full account of the process employed, with certificates of its being successfully carried into effect, be produced to the Society on or before the first Tuesday in March, 1820.

FINE BAR IRON.

63. To the person, in Great Britain, who shall make the greatest quantity of Bar-iron, not less than ten tons, with coak, from coak pigs equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal* or *Fifty Guineas.*

Samples, not less than one hundred weight, with certificates that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in March, 1820.

REFINING COPPER FROM THE ORE.

64. To the person who shall discover to the Society a method of separating, purifying, and refining Copper from the Ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than and superior to any hitherto known or in use;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than one hundred weight of the copper so refined, to be produced to the Society on or before the last Tuesday in February, 1820.

PREPARING BRASS.

65. To the person or persons who shall discover a method of making Brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country, and equal to foreign brass;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured, and a sample of the brass, not less than 14 lbs. to be produced to the Society on or before the last Tuesday in February, 1820.

PREPARATION OF SULPHURIC ACID, FROM SULPHUR, WITHOUT THE USE OF ANY NITRIC SALT.

66. To the person who shall prepare the largest quantity (not less than one ton) of Sulphuric Acid from sulphur, without any nitric salt, of a specific gravity not inferior to the best sulphuric acid of commerce;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that not less than the above quantity of such an acid has been prepared, together with a sample, to be produced to the Society on or before the first Tuesday in February, 1820.

PREPARATION OF ANY ALKALINE OR EARTHY NITRATE.

67. To the person who shall prepare, in Great Britain, the largest quantity, not less than one hundred weight, of any earthy or alkaline salt of Nitric Acid, by a method superior to, and as cheap as those hitherto practised;—*the Gold Medal*, or *One Hundred Guineas.*

Certificates of the above quantity having been prepared, and a sample of not

less than 28lbs. to be produced to the Society on or before the last Tuesday in February, 1820.

GLAZING EARTHEN-WARE WITHOUT LEAD OR ARSENIC.

68. To the person who shall discover to the Society, the cheapest, safest, most durable, and most easily fusible, composition, fit for the purpose of glazing Earthenware, without any preparation of lead, arsenic, or other pernicious ingredients, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

Specimens of the ware so glazed, with proper certificates of its having succeeded, and a sample of the materials made use of, to be produced to the Society on or before the first Tuesday in February, 1820.

CROWN GLASS.

69. To the person or persons who shall make Crown or Window Glass equally transparent, and as free from blue and green colour as the best German sheet;—*the Gold Isis Medal*, or *Thirty Guineas.*

Certificates that not less than two cwt. has been made, together with one whole plate and two of the largest squares that can be cut, and a full account of the proportions of the ingredients and of the process of manufacture, to be produced to the Society on or before the last Tuesday in February, 1820.

FLINT GLASS.

70. To the person or persons who shall make flint glass free from veins, and as dense and transparent as the best now in use, and quite fit for the purposes of Opticians;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process. with certificates that not less than two cwt. has been made, together with 20 lbs. in plates not less than six inches wide, and three quarters of an inch thick, to be produced to the Society on or before the last Tuesday in January, 1820.

DYEING SILK OR WOOLLEN.

71. To the person who shall discover a method of dyeing Silk or Woollen, of any colour, superior to the same produced by other British dyers, and equal to those produced by the Continental dyers;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk and woollen in its undyed and dyed state, to be produced to the Society on or before the first Tuesday in March, 1820.

DYEING DRAB COLOUR.

72. To the person who shall invent and discover to the Society the best method of dying kerseymere or any other woollen cloths of a drab colour that shall retain the colour in washing;—*the Gold Isis Medal*, or *Thirty Guineas.*

Certificates and particulars of the process to be produced to the Society, on or before the last Tuesday in February, 1820.

PREPARATION OF A RED STAIN FOR COTTON CLOTH.

73. To the person who shall communicate to the Society the most effectual method of printing or staining cotton cloths with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the above process, has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, one pound of the colour, and a full account of the preparation and application, to be produced to the Society on or before the second Tuesday in February, 1820.

PREPARATION OF A GREEN COLOUR FOR PRINTING COTTON CLOTH.

74. To the person who shall communicate to the Society the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions

of indigo;—*the Gold Medal*, or *Fifty Guineas.*

Certificates and conditions as for Premium 70.

BRITISH INDIGO.

75. To the person who shall prepare Indigo, or a substance equal to it, from any plants (except woad), the growth of Great Britain or Ireland, at a price not greater than that of foreign indigo of equal quality:—*the Gold Medal*, or *Fifty Guineas.*

A full account of the process and ingredients employed, together with their proportions, and satisfactory certificates that at least one cwt. of the indigo has actually been prepared; also a sample of the same weighing not less than 7lbs. to be produced to the Society on or before the last Tuesday in Feb. 1820.

SUBSTITUTE FOR THE BASIS OF WHITE PAINT.

76. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of white paint, equally proper for the purpose as the white-lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white-lead;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than 50 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in February, 1820.

PERMANENT WHITE PAINT FOR THE USE OF ARTISTS.

77. To the person who shall produce to the Society a White Paint for oil, superior to any hitherto known, and which is not liable to be discoloured by exposure to light or to sulphuretted hydrogen gas;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and 1lb. of the colour to be produced to the Society, on or before the second Tuesday in February, 1820.

RED PIGMENT.

78. To the person who shall discover to the Society a full and satisfactory process for preparing a Red Pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal*, or *Fifty Guineas.*

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1820.

N. B. It is required that the colour should remain unaltered by the common exposure to strong light, damps, and noxious vapours.

ULTRAMARINE.

79. To the person who shall prepare an artificial Ultramarine, equal in colour, brilliancy, and durability, to the best prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal*, or *Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

COLOURLESS LAC VARNISH.

80. To the person who shall produce to the Society a Lac Varnish equally hard with that made from shell or seed lac, and as fit for use in the arts, but deprived of its colouring matter;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and one quart of the varnish to be produced to the Society on or before the second Tuesday in January, 1820.

SUBSTITUTE FOR TAR.

81. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of the United Kingdom, or its colonies;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than one hundred weight, with certificates that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an account of the process, to be deli-

vered to the Society on or before the first Tuesday in March, 1820.

N. B.—Considerable quantities of tar are produced in Sweden and Norway from the roots of fir trees burnt for that purpose.

TURPENTINE FROM THE SCOTCH FIR, OR PINUS SYLVESTRIS.

82. For the greatest quantity of Turpentine, not less than two hundred weight, prepared in Great Britain, from that species of fir called the Scotch fir, or Pinus sylvestris, Linn.;—*the Gold Medal*, or *Fifty Guineas*.

Certificates of the Turpentine being prepared from such trees of British growth, together with fifty-six pounds of the Turpentine, to be delivered to the Society on or before the second Tuesday in March, 1820.

83. For the next greatest quantity prepared, not less than one hundred weight, on similar conditions;—*the Silver Medal*, or *Twenty Guineas*.

N. B. The Society being in possession of the method practised for extracting Turpentine from trees whilst growing, and of samples so procured, information will be given upon that subject, on application for that purpose, at the Society's house.

PREPARATION OF TAN.

84. To the person who shall prepare in the most concentrated form, so as to be easily portable, and at a price applicable to the purposes of manufacturers, the largest quantity, not less than one hundred weight, of the principle called Tannin, which abounds in oak bark, and many other vegetable substances; —*the Gold Medal*, or *Fifty Guineas*.

Certificates of the superior quality of the quantity so prepared, and a sample of not less than 28 lbs. to be produced to the Society on or before the last Tuesday in February, 1820.

PRESERVING SEEDS OF VEGETABLES.

85. For the best method of preserving Seeds of Plants in a state fit for vegetation a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the last Tuesday in December, 1820;—*the Gold Medal*, or *Thirty Guineas*.

PRESERVING SALTED PROVISIONS FROM BECOMING RANCID OR RUSTY.

86. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving Salted Provisions from becoming rancid or rusty;—*the Gold Medal*, or *Thirty Guineas*.

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the last Tuesday in February, 1820.

PRESERVING IRON FROM RUST.

87. To the person who shall invent and discover to the Society a cheap composition superior to any now in use, which shall effectually preserve Wrought Iron from rust;—*the Gold Medal*, or *Fifty Guineas*.

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with ten pounds weight of the composition, on or before the last Tuesday in January, 1820.

PREVENTING THE DRY-ROT IN TIMBER.

88. To the person who shall discover to the Society the cause of the Dry-Rot in Timber, and disclose a certain method of prevention superior to any hitherto known;—*the Gold Medal*, or *Thirty Guineas*.

The accounts of the cause and method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the last Tuesday in February, 1820.

Note.—For a method of curing and preventing the dry-rot in ship timber see Mr. Bowden's communication in Vol. 36 of the Society's Transactions.

DESTRUCTIVE EFFECTS FROM MOTHS.

89. To the person who shall discover to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the de-

structive effects occasioned by Moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal*, or *Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in January, 1820.

RENDERING LEATHER WATER PROOF.

90. To the person who shall discover a method, superior to any now in use, and of moderate price, of rendering Leather Water-proof, without injuring its texture or pliability;—*the Silver Medal*, or *Fifteen Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the leather in its unprepared and prepared state, to be produced to the Society on or before the last Tuesday in February, 1820.

REFINING WHALE OR SEAL OIL.

91. For disclosing to the Society an effectual method of purifying Whale or Seal Oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society to determine the validity of the claim; and certificates that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil in its unpurified state, and two gallons so refined, to be produced to the Society on or before the second Tuesday in February, 1820.

MANUFACTURING TALLOW CANDLES.

92. To the person who shall discover to the Society a method of hardening or otherwise preparing Tallow, so that candles may be made of it which will burn as clear and with as small a wick as wax candles, without running, and may be afforded at a less expense than any at present made with spermaceti;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that 112lbs. of such tallow have been made into candles, and 12lbs. of the candles made thereof, to be produced to the Society on or before the second Tuesday in February, 1820.

INDELIBLE INK.

93. To the person who shall discover to the Society a method of making a Black Ink proper for writing, superior to any at present known, indestructible by chemical applications, and not dearer than that which is now in common use;—*the Silver Medal*, or *Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities above-mentioned, with a full detail of the process of making it, and two quarts of the ink, to be delivered to the Society on or before the second Tuesday in February, 1820.

PRINTERS' INK.

94. To the person or persons who shall invent and discover to the Society the best composition for Printers Ink, superior to any hitherto known or in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that 112lbs. of such ink has been made, with a full account of the process employed, and 6lbs. of the ink, to be produced to the Society on or before the last Tuesday in February, 1820.

COPPER-PLATE PRINTERS' INK.

95. To the person or persons who shall invent and discover to the Society the best composition, superior to any hitherto known or in use, and fit for the finest kind of copper-plate printing;—*the Gold Medal*, or *Thirty Guineas.*

Certificates and conditions the same as for the last premium.

STATUARY MARBLE.

96. To the person who shall discover, within Great Britain or Ireland, a quarry of White Marble fit for the purposes of statuary, and equal to those kinds now imported from Italy;—*the Gold Medal*, or *One Hundred Guineas.*

A block of at least three feet in length, two in height, and two in width, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be pro-

duced to the Society on or before the first Tuesday in February, 1820.

N. B. In order to prevent useless expense or trouble to the Claimant in forwarding so large a block, the Society will be ready to examine any smaller specimen of the marble and express their opinion of its value to the Candidate before the block required by the above premium is produced.

STONE FOR LITHOGRAPHY.

97. To the person who shall discover within Great Britain or Ireland, a quarry of stone fit for the purposes of Lithography, equal at least to the stones imported from abroad;—*the Gold Isis Medal*, or *Thirty Guineas.*

A specimen of the stone at least two feet square and two inches in thickness, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the last Tuesday in February, 1820.

MINERALOGICAL COUNTY MAPS.

98. To the person who shall complete and publish the best Mineralogical Map of any County in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced with sections of the strata;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the accuracy of such maps, together with the maps, to be produced to the Society on or before the first Tuesday in February, 1820. The maps to remain the property of the Society.

MINERALOGICAL MAP OF IRELAND.

99. To the person who shall complete and publish an accurate Mineralogical Map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal* or *Fifty Guineas.*

MINERALOGICAL MAP OF SCOTLAND.

100. The same premium is offered for a Mineralogical Map of Scotland, on similar conditions.

NATURAL HISTORY.

101. To the author who shall publish in the year 1819, the Natural History of any county in the United Kingdom;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the several natural productions, animal, vegetable, and mineral, peculiar to the county, or found therein, be carefully and scientifically arranged and described, in order that the public may be enabled to judge what arts or manufactures are most likely to succeed in such county. The work to be delivered to the Society on or before the last Tuesday in February, 1820, and a copy to be the property of the Society.

PREMIUMS IN POLITE ARTS.

HONORARY PREMIUMS FOR NOBILITY.

102. For the best Original Painting or Drawing of any kind, by gentlemen under the age of twenty-one, sons or grandsons of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

103. For the best Copy on similar conditions;—*the Silver Medal.*

104. For the best original Painting or Drawing, of any kind, by ladies under the age of twenty-one; daughters or grand-daughters of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

105. For the best Copy on similar conditions;—*the Silver Medal.*

HONORARY PREMIUMS FOR GENTLEMEN OR LADIES.

106. For the best Original Painting in oil colours by gentlemen under the age of twenty five;—*the Gold Medal.*

107. For the best Copy in oil colours by gentlemen under the age of twenty one;—*the Silver Medal.*

108. For the best Original Drawing or Painting in water colours by gentlemen under the age of twenty five;—*the Gold Medal.*

109. For the best Copy in water co-

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lours by gentlemen under the age of twenty-one;—*the Silver Medal.*

110. For the best Original Painting in oil colours by ladies under the age of twenty-five;—*the Gold Medal.*

111. For the best Copy in oil colours by ladies under the age of twenty-one;—*the Silver Medal.*

112. For the best Original Drawing, or Painting in water colours, by ladies under the age of twenty-five;—*the Gold Medal.*

113. For the best Copy by ladies under the age of twenty-one;—*the Silver Medal.*

N. B. As the foregoing honorary premiums are intended only for the nobility and gentry; persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admited candidates in the above classes.

PREMIUMS FOR ARTISTS AND OTHERS.

114. For the best Historical Painting in oil colours, by gentlemen under the age of twenty-five;—*the Gold Medal.*

115. For the best Historical Painting in oil colours by ladies under the age of twenty-five;—*the Gold Medal.*

116. For the best Historical Drawing by gentlemen under the age of twenty-five;—*the Gold Medal.*

117. For the best Historical Drawing by ladies under the age of twenty five;—*the Gold Medal.*

118. For the best Copy in oil colours, of an Historical Painting, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

119. For the best Historical Drawing, being a Copy, by persons of either sex, under the age of twenty one;—*the Silver Medal.*

For the next in merit on similar conditions;—*the Silver Isis Medal.*

120. For the best Original Landscape, in oil, by persons of either sex, under the age of twenty five;—*the Gold Isis Medal.*

121. For the best Original Landscape in water colours, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

122. For the best copy of a Landscape by persons of either sex, under the age of eighteen;—*the Silver Isis Medal.*

123. For the best Original Portrait by ladies under the age of twenty five;—*the Gold Medal.*

124. For the best Original Painting or Drawing of fruit or flowers, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

125. For the best Original Drawing of any kind by persons of either sex under the age of twenty-five;—*the Gold Isis Medal.*

126. For the best Copy by persons under the age of twenty-one;—*the Silver Medal.*

DRAWINGS FROM SCULPTURE.

127. For the best finished Drawing of the Ilissus of the Elgin collection in the British Museum; the size of the Drawing not less than eighteen inches high, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

128. For the best finished Drawing of the Diana, No. 11, room 4, in the British Museum (the size of the drawing not less than 18 inches high) by persons of either sex under the age of twenty-one;—*the Silver Medal.*

129. For the best finished Drawing of an Homeric hero, marked No. 23, room 3, in the British Museum, not less than twelve inches in height, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

130. For the best Outline, after the plaster cast of the Laocoon, by persons of either sex, under the age of twenty-one, the figure not less than eighteen inches;—*the Silver Medal.*

PERSPECTIVE DRAWINGS.

131. For the best Perspective Drawing of machinery, by persons of either sex, under the age of twenty one;—*the Silver Medal.*

ARCHITECTURAL DESIGNS.

132. For the best Original Design for a national museum, consisting of plan, elevation, section, and perspective view, each to be the size of double elephant; the drawings to remain the property of the Society if required;—*the Gold Medallion.*

For the next in merit;—*the Silver Medallion.*

The following inscription to be engraved on these *Medallions;* "The Premium given by the Society for the Encouragement of Arts, Manufactures, and Commerce, in conformity to the Will of John Stock, esq. of Hampstead."

MODELS.

133. For the best Original Model of a group, by persons under the age of twenty-five;—*the Gold Medal.*

For the next in merit:—*the Gold Isis Medal.*

134. For a single figure by persons under the age of twenty one;—*the Silver Medal.*

135. For the best restored Model of the Ilissus in the Elgin collection, not less than three feet in length;—*the Gold Isis Medal.*

*** The Model to be baked or cast in plaster, and a cast from the Model in each case to remain the property of the Society if required.

ANATOMICAL MODELS.

136. For the best original anatomical model in wax;—*the Gold Medal.*

The Society in calling the attention of the public to the subject of anatomical modelling beg leave to refer to the beautiful specimens of this art at the Royal College of Surgeons.

ETCHING OF AN HISTORICAL SUBJECT.

137. For the best free Etching in historical composition, from a picture of eminence;—*the Gold Isis Medal.*

ETCHING OF A LANDSCAPE.

138. For the best free Etching in Landscape composition, from a picture of eminence;—*the Silver Medal.*

HISTORICAL ENGRAVINGS.

139. For the best finished Engraving in historical composition;—*the Gold Medal.*

LANDSCAPE ENGRAVING.

140. For the best finished Engraving in Landscape composition;—*the Gold Isis Medal.*

ENGRAVING OF A PORTRAIT.

141. For the best finished Engraving of a Portrait;— *the Gold Isis Medal.*

N. B. In the class of finished Engravings the Society requires an aqua-fortis impression, and a finished proof to be sent, and to remain with the Society.

ENGRAVING ON STEEL.

142. For the best specimen of engraving on a steel plate not less than 5 inches by 3 inches in area; the plate to be afterwards hardened without injuring the engraving;—*the Gold Medal.*

The Plate, with two impressions from it, both in its soft and hardened state, to be produced to the Society. The impressions, but not the plate, to remain the property of the Society.

ENGRAVINGS ON WOOD OR METAL BLOCKS.

143. For the best Engraving on Wood or Metal Blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the Block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the Block, to be produced to the Society. The impressions, but not the Block, to remain the property of the Society.

N. B. An impression from a block the subject of which has been recently drawn and etched with aqua-fortis on copper is deposited with the Society for the inspection of artists and others.

LITHOGRAPHY.

144. For the best specimen in this art, executed on stone the produce of the United Kingdom or its Colonies;—*the Gold Isis Medal.*

A particular account of the process employed, and the name of the quarry whence the stone was taken, with six impressions of the drawing, to be produced to the Society.

MEDAL DIE ENGRAVING.

145. For the best Die Engraving either of a single figure or group, after the engraver's own design and model;—*the Gold Medal.*

146. For the best Die Engraving of a head;—*the Gold Isis Medal.*

The Dies, with two impressions or casts, and the model, in each claim for Medal Die sinking, are to be produced to the Society, and the impressions or casts to remain the property of the Society.

CONDITIONS

FOR THE POLITE ARTS

All articles in the class of Polite Arts whether for claims or bounties, are to be produced to the Society on or before

the first Tuesday in March, 1820, and none can be received after that day.

No more than one performance in each class shall be received from the same candidate.

All performances to which premiums or bounties are adjudged shall remain with the Society until after the second Wednesday in June, 1820, when they will be re-delivered, unless mentioned, in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the claimant affix to his performance whatever mark he pleases, and that the same mark be inscribed on a paper sealed up, containing within, the name and residence of the Candidate, and *on the outside* the age and sex, and the number of the premium in claim of which the performance is offered; the name not to be disclosed unless the Candidate be successful, or in consequence of a special vote of the Society, or Committee. No production can be received with a view to obtain a bounty, which could have come into any of the foregoing classes.

To encourage real merit, and to prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the Candidate, the Society require a specimen of the abilities of each successful Candidate, to be made under the inspection of the Committee of Polite Arts.

All Candidates in the Polite Arts are required to signify, on their drawings, whether the performances are originals or copies; and if possible to send the originals from which the copies are taken.

All copies of drawings, &c. are to be on a different scale from the original.

The Society reserve to themselves the power of giving a Medal of less value than the premium offered, or of withholding the same altogether, in cases where the performance shall be deemed undeserving of reward.

PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

CLOTH FROM HOP STALKS, NETTLES, &c.

147. To the person who shall produce to the Society the greatest quantity, not less than thirty yards, of cloth, at least 27 inches wide, made in Great Britain or Ireland, of Hop Stalks or Bines, Nettles, or other raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be general afforded as cheap as cloth of equal quality and appearance now made from hemp, flax, or cotton, and much finer in quality than any hitherto manufactured in England from Hop Stalks &c.;—*the Gold Medal*, or *Thirty Guineas.*

One pound of the thread of which the Cloth is made, and thirty yards of the Cloth, together with proper certificates that the whole is manufactured from Hop Stalks, or Bines, &c. to be produced to the Society on or before the last Tuesday in February, 1820.

N. B. The Society is already in the possession of Cloth made in England from Hop Stalks or Bines, and Nettles, which may be inspected by application to the house-keeper.

SHEEP'S WOOL.

148. To the person who shall prove to the Society, that he has sold the largest quantity of Merino Wool, or such Wool as will answer the same purpose, being the produce of his own flock, in the United Kingdom, for the purpose of being manufactured into superfine cloth, the quantity of Wool not less than five hundred weight, in the year 1819;—*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it to be produced to the Society on or before the last Tuesday in March, 1820.

149. For the next greatest quantity, not less than two hundred and fifty

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pounds;—*the Silver Medal*, on similar conditions.

WICKS FOR CANDLES OR LAMPS.

150. To the person who shall discover to the Society, a method of manufacturing Hop-stalks or Bines, Nettles, or any other cheap material, the growth of the United Kingdom, so as to render them equally fit for the purpose of supplying the place of cotton, for Wicks of Candles or Lamps;—*the Silver Medal* or *Twenty Guineas.*

Samples, not less than 5lbs. weight, of the Wicks so prepared, to be produced to the Society on or before the last Tuesday in February, 1820, with certificates that the whole quantity is equal in quality to the sample.

WICKS FOR CANDLES.

151. To the person who shall make known to the Society the most satisfactory result of a series of experiments actually made by him to determine the best thickness of Cotton Wicks for Candles, so as to obviate the defects of those commonly used;—*the Silver Medal* or *Ten Guineas.*

Certificates that not less than one hundred weight have been so made, and six pounds of the Candles, to be produced to the Society, on or before the last Tuesday in February, 1820.

N. B. The intention in offering this premium is, to ascertain the proper thickness or bulk of the Wick in proportion to that of the tallow, and to remove the unpleasant consequences and waste arising from the sparkling, or guttering of the candles in common use.

PAPER FROM RAW-VEGETABLE SUBSTANCES.

152. To the person who shall, between the first of January, 1819, and the first of January, 1820, make the greatest quantity, and of the best quality (not less than ten reams) of good and useful paper, from raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as paper of equal quality and appearance now made from rags;—*the Silver Medal*, or *Twenty Guineas.*

N. B. The object of the Society being to add to the number and quantity of raw materials used in this manufacture, it is their wish to include every useful sort of paper, and to introduce such natural products as can be easily and cheaply procured in great quantities. The Society are in possession of two volumes containing a great variety of specimens of paper made from raw vegetable substances, viz. nettles, potato-haulm, hop-bines, &c. which volumes may be inspected by any person on application to the Housekeeper.

Certificates of the making such paper, and one ream of the paper to be produced on or before the second Tuesday in February, 1820.

TRANSPARENT PAPER.

153. To the person who shall discover to the Society a method of making Paper from the pulp, that shall be perfectly transparent, and of a substance and body equal to foolscap, that shall take and bear common writing-ink with the same facility and correctness as Writing paper generally in use;—*the Silver Medal*, or *Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced on or before the second Tuesday in March, 1820.

(INDIA PAPER, see page xxx.)

CHINTZ PATTERNS FOR CALICO PRINTERS.

154. For the best original pattern in a new taste, of light and dark-ground Chintz for garment work, or furniture, fit for the purpose of Calico-printers;—*the Silver Medal.*

A Copy of the pattern for which the premium is adjudged, to remain the property of the Society.

COPPER-PLATE PATTERNS.

155. For the best pattern, in a new style, fit for the purpose of calico-printers for garment-work or furniture;—*the Silver Medal.*

A Copy of the pattern for which the premium is adjudged, to remain the property of the Society.

N. B. The patterns for the two preceding premiums to be produced on or before the last Tuesday in February, 1820.

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GLOVES.

156. To the person who shall make known to the Society a process equal or superior to that of the French, for preparing, dying, and finishing the skins, verified by actual experiments, and the communication accompanied with at least a dozen pair of gloves made from skins so prepared;—*the Gold Medal*, or *Forty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society on or before the last Tuesday in March, 1820.

CAT-GUT.

157. To the person who shall discover to the Society the best method of manufacturing, in the United Kingdom of Great Britain and Ireland, the intestines of sheep, lambs, goats, or of any other animals, into the article called Cat-gut, equally strong, clear, smooth, even, and free from knots, as the best Italian strings, and at a price not exceeding what they are usually sold for in England;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that not less than fifty pound weight have been so prepared by the claimant, with a full detail of the process, and samples of the articles of various thicknesses, to be produced to the Society on or before the first Tuesday in February, 1820.

158. For the next greatest quantity, not less than twenty-five pounds;—*the Silver Medal*, or *Twenty Guineas*, on similar conditions.

HOSE FOR FIRE ENGINES, BREWHOUSES, &c.

159. To the person who shall invent and make known to the Society a method of making Hose for Fire Engines, Brewhouses, &c. similar to those used on the Continent, made of flax or hemp, or other flexible material cheaper than leather;—*the Gold Isis Medal*, or *Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of its efficacy in practice, to be produced to the Society on or before the last Tuesday in February, 1820.

THREAD FOR LACE.

160. To the person who shall invent or discover a method of manufacturing Thread from flax, for the making of Lace, of as fine quality as any used on the Continent;—*the Gold Medal*, or *Thirty Guineas.*

Samples of the Thread, not less than one pound in weight, and of the Lace made therefrom, together with certificates that not less than ten pounds in weight of each sort has been manufactured, to be produced to the Society, on or before the last Tuesday in March, 1820.

PREMIUMS IN MECHANICS.

GUNPOWDER MILLS.

161. To the person who shall invent and bring to perfection the most effectual method of so conducting the works of Gunpowder Mills in the business of making Gunpowder, as to prevent explosion;—*the Gold Medal*, or *One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more Gunpowder Mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1820.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of Gunpowder making which fall short of the total prevention of explosion; such bounty or reward will be bestowed on them as they may appear to merit.

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TRANSIT INSTRUMENTS.

162. To the person who shall invent and produce to the Society a portable Transit Instrument which may easily be converted into a zenith sector, capable of being accurately and expeditiously adjusted for the purpose of finding the latitudes and longitudes of places, and superior to any portable Transit Instrument now in use;—*the Gold Medal*, or *Forty Guineas.*

To be produced on or before the last Tuesday in February, 1820.

FAMILY MILL.

163. To the person who shall invent and produce to the Society, the best constructed Mill for Grinding Corn for the use of private families, or parish poor; the construction to be such as to render the working of the Mill easy and expeditious, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

The Mill, and certificates of its having been used to good effect, to be produced to the Society on or before the last Tuesday in February, 1820. Cheapness and simplicity will be considered as essential parts of its merit; and the Mill, or a model, to remain with the Society.

A PORTABLE MILL FOR GRINDING CORN.

164. To the person who shall invent and produce to the Society a Portable Corn Mill, superior to any now in use;—*the Gold Isis Medal*, or *Thirty Guineas.*

The Mill, and certificates of its efficacy from actual use, to be produced to the Society on or before the last Tuesday in February, 1820.

A PORTABLE OVEN.

165. To the person who shall invent and produce to the Society a Portable Oven, superior to any hitherto in use;—*the Silver Medal*, or *Twenty Guineas.*

The Oven, with certificates that it has been found to answer in use, to be produced to the Society, on or before the last Tuesday in February, 1820.

MACHINE FOR RAISING COALS, ORE, &c. &c.

166. To the person who shall invent a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use; and which shall produce the effect at less expense;—*the Gold Medal*, or *Fifty Guineas.*

A model of the Machine, made on a scale of not less than one inch to a foot, with a certificate that a machine at large on the same construction has been advantageously used, to be produced to the Society on or before the second Tuesday in February, 1820.

IMPROVED WALKING-WHEEL, OR CRANE.

167. To the person who shall invent an improved Walking Wheel or Crane, on which the weight or power of any person or persons shall be applied with the greatest safety and effect, and so contrived that the power can be varied according to the greater or less weight to be raised or lowered;—*the Gold Medal*, or *Thirty Guineas.*

The model on a scale of not less than one inch to a foot, with a proper certificate that the machine at large has been employed to good effect, to be produced to the Society on or before the second Tuesday in March, 1820.

MACHINE FOR RAISING WATER.

168. To the person who shall invent a machine on a better, cheaper, and more simple construction than any hitherto known or in use for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, on a scale of not less than one inch to a foot, to be produced to the Society on or before the last Tuesday in February, 1820.

EXTINGUISHING FIRES.

169. To the person who shall produce to the Society the best and most effectual method of procuring an immediate supply of water in case of Fire, or for the means best calculated to prevent or extinguish accidental Fires in buildings, superior to any now in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in January, 1820.

BORING AND BLASTING ROCKS.

170. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of Boring or Blasting Rocks in mines, shafts, wells, &c.;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the first Tuesday in February, 1820.

HEATING ROOMS FOR THE PURPOSE OF MANUFACTURERS.

171. To the person who shall invent and discover to the Society a method of Heating Rooms, superior to any hitherto known or in use, and at a moderate expense, for the purpose of painters, japanners, and other manufacturers, so as to avoid the necessity of iron or copper tunnels going through the rooms to convey the smoke, whereby the danger from such tunnels may be prevented;—*the Gold Medal*, or *Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society on or before the last Tuesday in March, 1820.

IMPROVED VENTILATION.

172. To the person who shall invent and produce to the Society a mode of permanently Ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used;—*the Gold Medal*, or *Fifty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates, to be delivered to the Society on or before the last Tuesday in February, 1820.

FOR PREVENTING ACCIDENTS FROM STAGE COACHES.

173. To the person who shall invent and discover to the Society a method or methods for preventing accidents arising from Stage Coaches;—*the Gold Medal*, or *Thirty Guineas.*

Ample certificates of its efficacy, and a description of the method, with models of the machinery used, to be produced to the Society on or before the last Tuesday in February, 1820.

N. B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not in some degree be prevented, by an alteration in the manner of placing the luggage.

PREVENTING ACCIDENTS FROM HORSES FALLING WITH TWO-WHEELED CARRIAGES.

174. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, to prevent accidents from the falling of Horses with Two-wheeled Carriages, especially on steep declivities;—*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates that the same has been used with success, to be delivered to the Society on or before the second Tuesday in February, 1820.

IMPROVING TURNPIKE AND OTHER ROADS.

175. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiments, of combining the materials ordinarily employed in making or repairing Roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat, or any other mode, so as to form an even, hard, and durable carriage-road;—*the Gold Medal*, or *Thirty Guineas.*

It is required that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society on or before the first Tuesday in March, 1820.

RAISING THE BODIES OF PERSONS WHO HAVE SUNK UNDER WATER.

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176. To the person who shall invent and produce to the Society a cheap and

Portable Drag, or other machine, superior to those now in use, for the purpose of taking up, in the best and most expeditious manner, and with the least injury, the bodies of persons who have sunk under water;—*the Gold Medal*, or *Thirty Guineas.*

The drag or machine, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in March, 1820.

FOR PREVENTING PREJUDICIAL EFFECTS TO THE PERSONS EMPLOYED IN POINTING NEEDLES.

177. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of Pointing Needles, by grinding them dry, during which the particles of grindstone-dust, and steel, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society on or before the second Tuesday in March, 1820.

A SUBSTITUTE FOR LEAD PIPES.

178. To the person who shall invent and produce to the Society, a substitute for the Lead Pipes used for conveying malt and other liquors from the cellars to the bars of public houses;—*the Gold Medal*, or *Fifty Guineas.*

The substance of which the Pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and at a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society on or before the last Tuesday in February, 1820.

PREVENTING EXPLOSIONS IN STEAM-ENGINE AND OTHER COVERED BOILERS.

179. To the person who shall invent and discover to the Society a method of rendering Steam Engines and other covered boilers safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal, and not less than Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society, on or before the last Tuesday in February, 1820.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE.

TAKING WHALES BY THE GUN-HARPOON.

180. To the person who shall strike and take the greatest number of Whales, not fewer than three, with the Gun-harpoon;—*Ten Guineas.*

Certificates of the striking such Whales, and that they were actually taken in the year 1818, signed by the master, or by the mate when the claim is made by the master, to be produced to the Society on or before the last Tuesday in December, 1819.

TAKING PORPOISES.

181. To the people in any boat or vessel, who, in the year 1819, shall take the greatest number of Porpoises, not fewer than thirty, on the coast of Great Britain or Ireland, by gun-harpoon, or any other method, for the purpose of extracting oil from them;—*the Gold Medal*, or *thirty Guineas.*

Certificates of the number, signed by the persons to whom they have been sold or delivered for the purpose of extracting the oil, to be produced to the Society on or before the last Tuesday in February, 1819.

OIL FROM PORPOISES, OR SUN FISH.

182. To the person who shall manufacture the greatest quantity of Oil from Porpoises or Sunfish taken on the coast of Great Britain or Ireland, in the year 1819, not less than twenty tons;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the oil having been made from porpoises or sunfish actually caught on the coast of Great Britain or Ireland, and two gallons of the oil as a sample, to be produced to the Society on or before the last Tuesday in February, 1820.

CURING HERRINGS.

183. To the person who shall send to the Society the best sample of White Herrings (not less than a sixteen gallon barrel) with certificates that not less than thirty barrels, equal in all respects to the sample, have been cured in a British or Irish vessel or port, by the person by whom the sample has been sent to the Society;—*the Gold Medal*, or *Fifty Guineas.*

Samples to be produced to the Society, on or before the first Tuesday in January, 1820, with certificates that the conditions of the premium have been fulfilled; together with a full description of the process employed.

In the 37th volume of the Society's Transactions, will be published a valuable communication from Mr. Denovan of Leith on the cure of British herrings, to which the Society particularly wish to direct the attention of such persons as intend to claim this premium.

CURING MACKAREL.

184. To the person or persons who shall, before January, 1820, cure the greatest quantity of Mackarel, not less in number than ten thousand, in the best manner and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal*, or *Twenty-five Guineas.*

185. For the next greatest quantity, not less than five thousand;—*the Silver Medal*, or *Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society on or before the first Tuesday in January, 1820, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums to be extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH COLONIES.

NUTMEGS.

186. For the greatest quantity of Merchantable Nutmegs, not less than ten pounds weight, being the growth of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or of the several islands adjacent thereto, and equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas.*

Satisfactory certificates, from the governor or commander in chief, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, to be produced on or before the first Tuesday in January, 1821.

The same premium is offered for the years 1822 and 1823.

KALI FOR BARILLA.

187. To the person who shall have cultivated, in the Bahama islands, or any other part of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, in the year 1819, the greatest

quantity of land, not less than two acres, with Spanish Kali fit for the purpose of making Barilla;—*the Gold Medal*, or *Thirty Guineas.*

188. For the next greatest quantity, not less than one acre;—*the Silver Medal*, or *Fifteen Guineas.*

Certificates, signed by the governor or commander in chief for the time being, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in February, 1820.

The same premiums, on similar conditions, will be given for Barilla grown in 1820 and 1821.

DESTROYING THE INSECT COMMONLY CALLED THE BORER.

189. To the person who shall communicate to the Society an effectual method of destroying the insect commonly called the Borer, which has of late years been so destructive to the sugar canes in the West India islands;—*the Gold Medal*, or *Fifty Guineas.*

The discovery to be ascertained by satisfactory certificates, under the hand and seal of the governor or commander in chief for the time being, and of some other respectable persons, inhabitants of the islands, or other place, in which the remedy has been successfully applied; such certificates to be delivered to the Society on or before the first Tuesday in February, 1820.

CULTIVATION OF HEMP IN UPPER CANADA.

190. To the person who shall sow with Hemp the greatest quantity of land in the province of Upper Canada, not less than six arpents (each four-fifths of a statute acre), in the year 1819, and shall at the proper season cause to be plucked the summer Hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed), on the ground until the seed is ripe;—*the Gold Medal*, or *One Hundred Dollars.*

191. To the person who shall sow with Hemp the next greatest quantity of land in the same province of Upper Canada, not less than five arpents, in the year 1819, in the manner above-mentioned;—*the Silver Medal*, or *Eighty Dollars.*

192. For the next greatest quantity of land, in the same province, and in a similar manner, not less than three arpents;—*Forty Dollars.*

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad-cast or in drills, the expense, soil, cultivation and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, together with 28lbs. of the hemp, and two quarts of the seed, on or before the last Tuesday in April, 1821.

CULTIVATION OF HEMP IN LOWER CANADA.

193 to 195. Premiums exactly similar in all respects to those held out for the province of Upper Canada, are also offered for the province of Lower Canada.

CULTIVATION OF HEMP IN NOVA SCOTIA AND NEW BRUNSWICK.

196 to 198. Similar premiums in all respects are also offered to the provinces of Nova Scotia and New Brunswick.

IMPORTATION OF HEMP FROM CANADA, NOVA SCOTIA, AND NEW BRUNSWICK.

199. To the master of that vessel which shall bring to this country the greatest quantity of Marketable Hemp, not less than one hundred tons, in the year 1819, the produce of Canada, or of one of the above-mentioned provinces;—*the Gold Medal.*

200. To the master of that vessel which shall bring the next quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel on or before the first Tuesday in February, 1820, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

SUBSTITUTE FOR HEMP.

201. To the person who, in the year 1818, shall discover and produce to the Society a substitute for Hemp, equally

cheap, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal*, or *Fifty Guineas.*

A quantity of the substitute, not less than one hundred weight, together with the proper certificates from the governor or commander in chief, if raised in any of the British colonies, or from the Secretary of the Board of Trade, if raised in the East Indies, to prove that the same has been used with success, to be produced to the Society on or before the last Tuesday in February, 1820.

N. B. The premiums from No. 186, to 201, are all extended one year farther, on similar conditions.

SILK.

202. For the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, produced by any person in the Isle of France, or in Malta, or islands near or adjacent thereto, in the possession of Great Britain, in the year 1818, from Silk-worms bred there;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the Silk, not less than one pound, with an account of the method in which the Silk-worms were managed; the kind and size of the mulberry-trees from whence they were furnished with food, and particulars respecting the culture of the mulberry trees for that purpose, to be produced to the Society on or before the first Tuesday in March, 1820.

203. For the next greatest quantity, not less than fifty pounds, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

Satisfactory certificates from the governor or commander in chief of the district where the said Silk was produced, and of the several particulars above mentioned, to be delivered to the Society along with the samples required.

N. B. The same premiums, on similar conditions, will be given for Silk produced in the year 1819.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH SETTLEMENTS IN THE EAST INDIES.

INDIA PAPER FOR COPPER PLATE PRINTING.

204. To the person who shall communicate to the Society the best account of the process employed in India or China in the manufacture of Paper used in England for Copper Plate Printing, and known by the name of India Paper, together with an account of the materials from which such Paper is made;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates signed by the Secretary of the Board of Trade of the respective settlement, to be produced to the Society on or before the first Tuesday in March, 1821, or 1822.

BHAUGULPORE COTTON.

205. To the person who shall import into the port of London, in the year 1819, the greatest quantity, not less than one ton, of the Bhaugulpore Cotton, from which Cloths are made in imitation of nankin, without dying;—*the Gold Medal.*

A quantity of the Cotton, not less than five pounds weight, in the pod, and five pounds carded, to be produced to the Society, with proper certificates, signed by the Secretary of the Board of Trade of Bengal or Bombay, on or before the last Tuesday in February, 1820.

ANNATTO.

206. To the person who, in the year 1819, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of annatto, not less than five-hundred weight;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the Secretary of the Board

of trade of the respective settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1820.

TRUE COCHINEAL.

207. To the person, who in the year 1819, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of true Cochineal, not less than three hundred weight;—*the Gold Medal.*

A quantity of the Cochineal, not less than three-pounds weight, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the Cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1820.

N. B. The premiums from No. 204 to 207 inclusive, are all extended two years farther, on similar conditions.

BRITISH MARBLES.

THE SOCIETY considering that it would be beneficial to the Commerce of the United Kingdom to bring the British Marbles into general use, and that the most effectual method of accomplishing their object would be, *for the present*, to make them more generally known in the Capital, have come to the following Resolution:

Resolved, That specimens of British Marbles be exposed in the Society's Rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name of the parish where situated, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the Marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of Marble Quarries will favour them with a specimen of the Marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected that the interest of the proprietors of the quarries will be promoted, and the use of British Marble much extended. A variety are already exhibited in the Society's Rooms.

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REWARDS BESTOWED BY THE SOCIETY DURING THEIR SESSION WHICH COMMENCED ON THE FIRST WEDNESDAY IN NOVEMBER, 1818, AND CLOSED ON THE 18TH OF JUNE, 1819.

IN AGRICULTURE AND RURAL ECONOMY.

1. *To W. W. Thackeray, M. D. of Chester*, for planting 188 Acres with Forest Trees, *the Gold Medal.*
2. *To Ralph Creyke, Esq. of Dotterill Park near Beverley*, for planting 187 Acres with Forest Trees, *the Silver Medal.*
3. *To Charles Fyshe Palmer, Esq. M. P. of Luckley near Oakingham, Berks*, for planting 115 Acres with Forest Trees, *the Silver Ceres Medal.*
4. *To Mr. J. Beckway, of Lewisham, Kent*, for a machine for weighing and binding hay, *the Silver Isis Medal* and *Fifteen Guineas.*
5. *To Mr. T. Lane, of Stockwell*, for a Fruit Gatherer, *Ten Guineas.*
6. *To Mr. E. Roberts, of Mold, Flintshire*, for a Churn, *Five Guineas.*

IN CHEMISTRY.

1. *To John Young, Esq. Fellow of the Royal College of Surgeons, Edinburgh*, for an improved method of collecting and preparing Opium in Britain, *the Gold Isis Medal.*
2. *To Mr. W. Cook, Prescott-street, Goodman's-fields*, for preserving anatomical preparations in brine, *the Silver Medal.*

IN POLITE ARTS.

Honorary Class.—1. ORIGINAL.

1. *To Mrs. C. Pearson, Great St. Helens*, for an Original Landscape in Oil, *the Gold Isis Medal.*
2. *To Mr. John Monro, Adelphi Terrace*, for an Original Landscape in water-colours, *the Silver Medal.*
3. *To Miss Chapman, Ivy House, Richmond*, for an Original Painting of fruit, &c. *the Silver Isis Medal.*

2. COPIES.

4. *To the Hon. Miss E. J. G. Burrell*, for a Drawing of Flowers in water-colours, *the Silver Medal.*
5. *To Miss S. L. Oakes, Mitcham, Surrey*, for a Chalk Drawing of Figures, *the Silver Medal.*
6. *To Mr. W. Hodges, Clapham Common*, for an Historical Drawing, *the Silver Medal.*
7. *To Miss Comber, Manchester*, for a Landscape in Oil, *the Silver Isis Medal.*
8. *To Miss H. S. Smith, East-street, Red Lion-square*, for a Chalk Drawing of Figures, *the Silver Isis Medal.*
9. *To Mr. W. H. Peppercorne, Kennington*, for a Pencil Drawing, *the Silver Palette.*
10. *To Mr. W. Wilby. St. Bartholomew's Hospital*, for a Chalk Drawing, *the Silver Palette.*

Class for Artists and others.—1. ORIGINAL.

11. *To Miss Cotton, Chichely, near Newport Pagnel*, for a Drawing of Flowers, *the Silver Medal.*
12. *To Mrs. Delap, Harley-street*, for a Drawing of Flowers, *the Silver Medal.*
13. *To Miss M. Ross, Upper Charlotte-street, Fitzroy-square*, for a Portrait in Chalk, *the Silver Isis Medal.*
14. *To Miss G. Huntley, Buckingham-place, Fitzroy-square*, for a Landscape in water-colours, *the Silver Palette.*

2. COPIES.

15. *To Miss C. H. Evatt, Wandsworth*, for a Portrait in Oil, *the Gold Isis Medal.*
16. *To Mr. W. Edwards, Percival-street, Clerkenwell*, for a Portrait in Oil, *the Gold Isis Medal.*

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17. *To Mr. H. Leveque, Brompton-row,* for an Enamel Painting, of Figures, *the Silver Medal.*
18. *To Mr. W. Warman, New Bond-street,* for a Drawing in water-colours of Figures, *the Silver Medal.*
19. *To Mr. J. Godden, Seymour Crescent, Euston-square,* for a pen and ink Drawing of a Horse, *the Silver Medal.*
20. *To Miss Adams, Upper Charlotte-street, Fitzroy-square,* for an Oil Painting of Figures, *the Silver Medal.*
21. *To Mr. J. Kennedy, New Bond-street,* for a Portrait in Indian Ink, *the Silver Isis Medal.*
22. *To Mr. H. C. Meillon, Paddington,* for a Landscape in Oil, *the Silver Isis Medal.*
23. *To Mr. S. Henning, Pentonville,* for an Intaglio, *the Silver Isis Medal.*
24. *To Master F. R. Say, Norton-street, Fitzroy-square,* for a Figure in Chalk, *the Silver Isis Medal.*
25. *To Mr. J. Carter, Gee-street, Somers Town,* for an Architectural Drawing in Indian Ink, *the Silver Isis Medal.*
26. *To Mr. E. Taylor, Warren-street, Fitzroy-square,* for a Pen and Ink Drawing of Figures, *the Silver Isis Medal.*
27. *To Mr. H. N. Crellin, Ratcliffe-Highway,* for a Figure in Indian Ink, *the Silver Palette.*
28. *To Mr. S. H. Cecil, Stafford-place, Pimlico,* for a Chalk Drawing of Figures, *the Silver Palette.*
29. *To Mr. F. I. Langdon, Paddington,* for a Pen and Ink Drawing of Figures, *the Silver Palette.*

DRAWINGS FROM BUSTS.

30. *To Mr. J. Williams, Bermondsey,* for a Drawing from the Elgin Theseus, *the Silver Medal.*
31. *To Mr. F. Ross, Bow-street,* for do. *the Silver Palette.*
32. *To Mr. F. Robson, Poland-street,* for do. *the Silver Palette.*
33. *To Mr. C. G. Cooke, Upper George-street, Bryanstone-square,* for do. *the Silver Isis Medal.*
34. *To Mr. W. Bagg, Frith-street, Soho,* for a Drawing from the Bust of Hercules in the British Museum, *the Silver Medal.*
35. *To Mr. C. R. Robinson, Devonshire-street, Portland place,* for do. *the Silver Palette.*
36. *To Miss G. Ross, Bow-street,* for do. *the Silver Palette.*
37. *To Mr. H. H. Watts, Providence-Row, Finsbury-square,* for do. *the Silver Palette.*
38. *To Mr. H. C. Slous, Bayham-street, Camden Town,* for a Drawing from the head of Jupiter, *the Silver Palette.*

ORIGINAL ARCHITECTURAL DESIGNS.

39. *To Mr. R. Kelsey, Bermondsey,* for a Design for a Nobleman's Mansion, *the Silver Isis Medal.*
40. *To Mr. J. P. Hedgeland, Warren-street, Fitzroy-square,* for a Design for a Nobleman's Mansion, *the Silver Medallion.*

ENGRAVINGS.

41. *To Mr. Clint, Gower-street,* for an Historical Engraving, *the Gold Medal.*
42. *To Mr. J. Vendramini, Brompton-row,* for do. *the Gold Isis Medal.*
43. *To Mr. W. Ward, Jun. Warren-street, Fitzroy-square,* for a Mezzo-tinto Engraving, *the Silver Medal.*
44. *To Mr. J. Thompson, Peckham,* for an Engraving on Wood, *the Silver Medal.*
45. *To Mr. W. R. Smith, Seymour Crescent, Euston-square,* for an Engraving of a Landscape, *the Silver Isis Medal.*

MEDAL DIE ENGRAVINGS.

46. *To Mr. B. Wyon, Vauxhall-walk, Lambeth,* for an Original Medal Die, *the Gold Medal.*
47. *To Mr. B. Faulkener, Birmingham,* for do. *the Gold Isis Medal.*
48. *To Mr. T. Wells, Birmingham,* for do. *the Silver Medal.*
49. *To Mr. W. Scowlar, Berners-street,* for an Original Portrait in Wax, *the Silver Medal.*
50. *To Mr. J. Hennings, Pentonville,* for his restoration of the Frieze of the Parthenon, *the Gold Isis Medal.*
51. *To Mr. Aloys Senefelder,* the Inventor of Lithography, *the Gold Medal.*
52. *To Mr. C. Hulmandel, Great Marlborough-street,* for a Lithographic Drawing, *the Silver Medal.*
53. *To Mr. D. Redman,* for ditto, on English Stone, *the Silver Isis Medal.*
54. *To Mr. W. Behnes, Newman-street,* for an Instrument for transferring points to Marble, *the Gold Isis Medal.*
55. *To Mr. D. Napier, Loyd's-court, Soho,* for a Tracing Instrument, *Ten Guineas.*
56. *To Mr. S. Einsle, Westminster,* for Ivory Paper, *Thirty Guineas.*

57. *To Mr. J. Barraud, Charles-street, Westminster*, for an improved Violoncello, *the Gold Isis Medal.*

IN MANUFACTURES.

1. *To Mr. G. Rhodes, Saddleworth*, for a Machine for Drying Woollen Warps, *the Silver Isis Medal, and Ten Guineas.*

IN MECHANICS.

1. *To Mr. W. Hardy, Wood-street, Spa-fields*, for an inverted Pendulum, *the Gold Isis Medal.*
2. *To Mr. T. Taylor, Royal Observatory, Greenwich*, for a Repeating Alarum, *Fifteen Guineas.*
3. *To Mr. J. Fayrer, White Lion-street, Pentonville*, for a Sidereal Regulator, *the Silver Isis Medal.*
4. *To Mr. B. Donkin, Bermondsey*, for a Counting Machine, *the Gold Isis Medal.*
5. *To Mr. W. Rodger, Lieutenant in the Royal Navy*, for a Life Raft, *the Gold Medal.*
6. *To Mr. T. Cook, Lieutenant in the Royal Navy*, for ditto, *the Gold Medal.*
7. *To Mr. A. Bell, Bermondsey*, for a Universal Chuck, *the Silver Medal* and *Ten Guineas.*
8. *To Mr. T. Hack, Bankside*, for ditto. *the Silver Medal.*
9. *To Mr. Feetham, Ludgate-hill*, for an Apparatus for Sweeping Chimnies, *The Silver Medal.*
10. *To Mr. R. Green, Lisle-street, Leicester-square*, for a Plough Guage for cutting Leather, *the Silver Isis Medal.*
11. *To Mr. W. Bullock, Queen-street, Soho*, for a Screen Spring, *the Silver Isis Medal*, and *Five Guineas.*
12. *To Mr. W. Russell, Chelsea*, for a Lock for Liquor Cocks, *the Silver Medal.*
13. *To Mr. W. Aust, Hoxton*, for a Pump, *Twenty Guineas.*
14. *To W. Brabazon, Esq. Portland-place*, for a Row-lock, *the Silver Medal.*
15. *To Mr. J. White, Laystall-street*, for a double Door Spring, *the Silver Isis Medal*, and *Ten Guineas.*
16. *To Mr. A. Ainger, Everett-street*, for a Self-adjusting Crane, *the Silver Medal.*
17. *To Mr. J. Malam, Romney-terrace, Westminster*, for a Gas Meter, *the Gold Isis Medal.*
18. *To Mr. J. Cuthbert, Saint Martin's-Lane*, for a Pneumatic Trough and Blow-Pipe, *the Silver Medal.*
19. *To Captain Thomas Bagnold, Knightsbridge*, for an Improved Method of fixing the Cartouch-Box in the Naval Service, *the Silver Isis Medal.*
20. *To Mr. J. Monk, Tonbridge*, for Lessening the risk of Explosion in Gun-powder Mills, *the Silver Medal*, and *Twenty Guineas.*
21. *To Mr. R. Phillips, Addle-hill*, for preventing the Wheel coming off when the Axle breaks, *the Silver Medal.*
22. *To Mr. G. Smart, Westminster-bridge*, for a Bow and String Rafter, *the Silver Medal.*

IN COLONIES AND TRADE.

1. *To Mr. I. F. Denovan, Leith*, for Improvements in the Curing of British Herrings, *Fifty Guineas.*

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TRANSACTIONS.

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PAPERS

IN

AGRICULTURE.

N° I.

FOREST TREES.

The GOLD MEDAL *of the Society was this Session presented to* W. M. THACKERAY, *Esq. M. D. of Chester, for planting* 188 *Acres with* FOREST TREES.—*The following communications have been received from him on the subject.*

Chester,
November, 1818.

SIR;

I HOPE I shall be thought to have duly appreciated the high honour conferred upon me by the Society for the Encouragement of Arts, &c. which, in the years 1809 and 1813 presented me with Gold Medals for Plantations which I had made in the counties of Denbigh and Merioneth.

The ground then planted exceeded three hundred and sixty acres. It was the property of my step-son, John Maurice Jones, Esq. whose means enabled me to carry on the extensive undertaking conformably to my wishes,

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though various discouragements were thrown in my way by the calculating part of my friends, who hinted that I might involve my own property, in the event of my ward's not approving, when he came of age, of what I had done; and that, at all events, I should obtain little thanks for presenting him with 360 acres of *stunted* trees, instead of a sum of money sufficiently ample to enable him to launch into the world with spirit, or, in other words, to uphold a system of profusion and thoughtless extravagance.

The disposition of the young man (who lived to take the management of his property into his own hands, but unhappily held it only for a short period, having died in his 22nd year) was of the most generous kind. To evince his approbation of what I had done in the improvement of his estate, he made bequests of great liberality both to me and my children. Happily, those of my friends who considered that I was involving myself in difficulties, have had abundant reasons to correct their judgment, from the successful issue of my endeavours, and the prosperous and flourishing state of the plantations. I saw with great satisfaction, that the interest which the planter invariably feels, was taking a firm hold of the mind of my friend, as his views respecting the advancement and utility of planting were in strict keeping with my own. Had he lived, he would, I am fully confident, have exhibited in his life those valuable traits which are only to be found in the character of an exemplary country gentleman.

If experiment had been my object, I could hardly have selected a tract of land more adapted to the purpose, from its elevated situation, and rocky and intractable soil. I have, however, the pleasure of stating that the attempt has *completely succeeded* in ascertaining the encouraging point that there are few spots, however sterile in appearance, and ostensibly unfavourable to the designs of the

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cultivator, where plantations, if judiciously made, and properly attended to afterwards, will not thrive.

I have lately returned from a minute investigation of these extensive plantations, and am certain that their condition could not have been more healthy and flourishing. I attribute their surprising growth (the nature of the soil considered) to the *annually* taking out from *three* to *six* of the *thickest* and most *thriving* of the side-shoots, *smooth* and *close* to the *main stem*, which has thrown *proportionate strength* and *vigour* into the leader; and likewise to the *gradually thinning* of them, having reduced their number from 4,840 per acre, to between 6 and 700. More flourishing trees cannot, I may safely aver, be seen on any estate. It is very evident, that too many and large, as noticed by Mr. Pontey, as well as too numerous young and luxuriant branches, are alike operative in decreasing the growth of the timber in the trunk, in comparison with heads of a moderate size and proper form. The trees removed have been planted in hedge-rows at about three yards from each other, and at this distance, in a mountainous country, will grow into useful and valuable timber. Much of our success is also attributable to our *unremitted care* and *attention* in protecting them by good fences from the inroads of sheep and cattle of every description. Your valuable Society cannot render greater service to the country than by forcibly impressing on the minds of planters, the *absolute necessity* of paying a due regard to these three points, for unless it be done, it will be folly, nay madness, to plant. The fencing must be constructed, if possible, by walls of a proper height, or by sufficiently wide ditches, or quicksets.

Many persons have objected to pruning the trees planted in belts or woods, under the idea that it will deprive the game of necessary shelter and protection.

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This objection I have obviated, by converting some of the young oaks, elm, &c., into layers, and covering them at intervals with turf or earth, thereby raising at pleasure, in various situations, a sufficient quantity of underwood, to preserve the game from the hands of the poacher. The complicated state too in which the plants and layers may be made to grow, will tend, in a great measure, to retard the progress of that intruder, and, in many instances, to render completely ineffectual his nefarious designs.

It must be generally acknowledged that planting has much increased of late years, and that increase has resulted from an opinion entertained by a considerable part of the landed proprietors, that the cultivation of land in that way will prove eminently beneficial to the kingdom. A spirit, indeed, highly laudable and praise-worthy, seems to be diffusing itself among the above-constituent part of the British community, indicative of their determination to check the great importation of *foreign*, by the production of *native* timber. To effect this desirable object, their exertions should not suffer any relaxation, nor cease when they put their trees into the ground. At that period, the labour of a scientific planter commences; and though it may not, at first, prove the most pleasant employment, the effects of his attentions greatly interest him in the proper culture and improvement of his trees. SKILFUL PRUNING IS THE GRAND STIMULANT TO THE GROWTH OF A TREE: unless this requisite be attended to, the mere planting of a tree will be of little good. It is hoped, therefore, that as a neglect of pruning is highly detrimental to the thriving of forest trees, it will be the especial care of the planter to avoid this evil, and strictly attend to the means declared by men of experience to be conducive to their health, and productive of tall, straight, and round timber.

I have stated the particulars, and by that means have

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enabled the planter to calculate to a trifle his expenses per acre in planting and preserving his trees.

I have now only to add, that I feel so thoroughly convinced of the wisdom and policy of covering with timber trees that portion of mountain land which is unproductive of pasture, that I have purchased, in the parish of Mold, and county of Flint, upwards of three hundred acres, one hundred of which were inclosed, the remainder was common land. About one hundred and sixty acres were planted between the years 1815 and 1817, and I trust, that by skilful management of this property, I shall secure to my children a reversion annually increasing in value, and that on land which originally cost but little.

The land that I have allotted to planting, is very high and exposed, bushy, heathy, and peaty, having on it a crust of poor and dry soil. These unfavourable circumstances might have deterred a more cautious person than myself from an attempt to cultivate it, but the satisfactory results of my former undertakings, encouraged me to proceed.

I know not whether the number of acres planted, or the care taken of them, or both united, will authorize me to appear again as a candidate for the approbation of the Society; but if they should justify the act, I beg leave to say, that I should value, as a testimony that I have been usefully employed, any tribute of the favour of a body of gentlemen whose services for the improvement and amelioration of their country none doubt, and which all who reflect upon them must very highly appreciate.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. M THACKERAY.

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CERTIFICATES.

I DO hereby certify and declare that I have viewed the plantations, the property of W. M. Thackeray, Esq. M.D. in the parish of Mold, consisting of 159 a. : 2 r. : 28 p. of land heretofore uncultivated and unproductive; that they are surrounded with a good fence, and the trees perfectly secured from depredation of sheep and cattle; and I entertain no doubt of their being, in a very few years, most thriving and valuable woods.

EDWARD JONES HUGHES.

Plas-On,
Nov. 24, 1818.

I DO hereby certify and declare that W. M. Thackeray, Esq. M. D. of the city of Chester, did plant in the parish of Mold, in the county of Flint, near one hundred and sixty acres of land, too barren to repay the expense of tillage, and that the trees are healthy, and growing with vigour, and that the whole of the fences are in excellent condition.

WILLIAM WILLIAMS.

Garry-Glwyd,
Nov. 24, 1818.

I DO hereby certify and declare that, by order of W. M. Thackeray, Esq. M. D. of the city of Chester, I planted 92 a. : 0 r. : 18 p. of land in the parish of Mold, lately inclosed, with oak, beech, ash, elm, sycamore, scotch fir, and larch, at the rate of 4,840 trees per acre; and that the said land is well fenced, with a good wall, or quicksets, and posts and rails.

I do further certify and declare that I have *annually pruned* and *thinned*, for the last twelve years, by Dr. Thackeray's order, the plantations made by him for his

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step-son, John Maurice Jones, Esq. and now the property of Wilson Jones, Esq. between Nov. 1804 and May, 1813, consisting of more than three hundred and sixty acres, and that the trees are in a very thriving condition.

THOMAS ROBERTS, *Planter.*

Gallygonnan,
Nov. 24, 1818.

I DO hereby certify and declare that William Jones (since dead) and myself, nurserymen of the city of Chester, did plant for W. M. Thackeray, Esq. near seventy acres of land, in the parish of Mold, and county of Flint, between the years 1815 and 1816, after the rate of 4,840 trees per acre, for which I received, at the time of planting, 1*l.* 5*s.* per acre; 2*l.* per acre the following Christmas; and the remaining sum of 15*s.* per acre at the end of the third season, having engaged to replace every tree injured or destroyed for three succeeding seasons.

THOS. WEAVER.

Chester,
Nov. 24, 1818.

SIR;

Chester,
Jan. 6, 1819.

IN the statement I made to you of the number of acres planted by me, I omitted to enter twelve acres at a farm called Bryncandig, and sixteen acres at a farm called Wennalt, which I will thank you to add to the account I transmitted in December.

Believing it may be interesting to the members of the

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Society, I have now sent my planter's and pruner's report of the growth of a few trees in one plantation, situate in a very cold spot in the parish of Llanarmon.

I am, Sir,
&c. &c. &c.
W. M. THACKERAY.

		Girth.	*Length.*
Beech -	N° 1	13 inches	22 feet
	2	14	23
Sycamore,	1	14½	28
	2	15	30
Ash - - -	1	14½	27
	2	15½	29
Oak - - -	1	10	24
	2	10	25
Scotch Fir,	1	22½	26
	2	24	28
	3	30	23
Larch - -	1	22½	27
	2	23	28
	3	24	27
	4	24½	28
	5	25	28
	6	26	24
	7	26½	26

THOS. ROBERTS, *Planter.*

Llanarmon,
Dec. 21, 1818.

The above trees were planted between November, 1804, and May, 1805.

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N° II.

FOREST TREES.

The SILVER MEDAL *of the Society was this Session presented to* RALPH CREYKE, *Esq. of Dotterill Park, near Beverley, Yorkshire, for planting* 187 *Acres with* 905,080 FOREST TREES. *The following communication has been received on the subject.*

Beverley,
January 29th, 1819.

SIR;

I AM requested by Ralph Creyke, Esq. of Dotterill Park, near this place (to whom the Society of Arts last session awarded their Silver Medal for plantations of Forest Trees), to submit on his part a second claim to the honorary reward of the Society.

In the year 1815, I planted for Mr. Creyke a piece of land at Kilham, in the East Riding of Yorkshire, amounting to 187 acres. Of the trees, two-thirds are ash, and the other third consists of elms, Scotch firs, and spruce firs in nearly equal proportions. The plants stand three feet apart, that is, 4,840 on each acre, making a total of 905,080 plants. The vacancies occasioned by casualties of various kinds have been regularly filled up, and the plantation is now in a very fine and thriving condition, in every respect calculated to be of the greatest utility to the adjacent country. The whole is surrounded with a ring fence, and the land, which was sheep-walk, situated on the most elevated part of the North Yorkshire

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Wolds, is, both from its open exposure, and the barrenness of its soil, very little adapted to agricultural undertakings.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEORGE TINDALL.

CERTIFICATE.

I HAVE carefully inspected the plantation at Kilham, made in 1815, by Mr. Tindall for Ralph Creyke, esq. I find it to be in the most healthy, thriving state, well fenced and protected, and likely to be of much use to the country. The land is a barren and indifferent soil for agricultural purposes.

(Signed) RICHARD HEPPER.

Kilham,
January 28, 1819.

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N° III.

FOREST TREES.

The SILVER CERES MEDAL *of the Society was this Session presented to* CHARLES FYSHE PALMER, *Esq., M. P. of Lackley, near Oakingham, Berks, for planting* 115 *Acres with* FOREST TREES.—*The following communications have been received from him on the subject.*

Lackley, Oakingham, Berks,
March 4th, 1818.

SIR;

I HAVE the honour of inclosing to you a letter on the subject of some plantations I have lately made on land allotted to me in Windsor forest; and I beg the favour of you to lay it before the Committee appointed to consider and report on such communications to the Society of Arts, &c.

Local circumstances have precluded me from complying with conditions prescribed by the Society, to candidates for certain premiums in planting, but I indulge the hope, that, as I have realized what have always been the Society's great object, viz. conversion of sterile wastes to profitable culture, and improvement in the progress of planting by a cheap process, I may therefore be considered as not unworthy of some mark of their approbation.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. CHARLES FYSHE PALMER.

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Lackley,
February 27th, 1818.

SIR;

In expectation of the inclosure of Windsor forest, where I am a considerable proprietor, I had directed my attention for some years to the raising a quantity of such plants as I thought most likely to grow into timber upon that poor and barren soil. For this purpose I had filled a nursery of seven acres with Scotch firs, larch, sycamore, and 180,000 cuttings of the black Italian poplar. It was towards the middle of February, 1816, when the commissioners, appointed to act under the inclosure, allowed me to begin my plantations. My first object was, to prepare the ground for the reception of the plants, as I had observed that all the plantations in that neighbourhood had made scarcely any advance during the first six or eight years; a check which I attribute to the want of effectually loosening the ground, so as to enable the tender fibres of the roots to extend themselves. But to obviate this inconvenience, and to set about an extensive work of this kind with the spade, would have increased the expense so much, as to have obliged me to curtail my views very considerably, or to abandon the plan altogether. I therefore made use of a large, strong plough (commonly called a Parish Plough), which turned over a furrow very completely of seven inches in depth, and eighteen inches in width; and this plough was immediately followed by an instrument which I constructed for the purpose, consisting of three large teeth, twelve inches apart from each other, and which entered into the ground eight or ten inches below the first furrow, and pulverised it equal to spade-work.

For the convenience of planting, I ploughed in nine-bout lands, leaving a space of one yard between the lands, and by this method the trees stand in rows at the regular

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distance of either three or four feet from each other. By the tenth of May, I had prepared ninety acres of ground in this manner, and had planted it with trees of different kinds; and in those parts of the heath where the ploughs could not be conveniently used, I had nicked in Scotch firs at a yard apart; and had covered twenty-five acres adjoining to that which had been ploughed, making in the whole a plantation of one hundred and fifteen acres. I have every reason to be satisfied with the growth and healthy appearance of the trees, and with my first efforts as a planter, though I have made some alterations in the plough, by which means the expense and labour are considerably reduced; and I have been enabled to plant a larger tract of land this last year. The situation of the ground, as well as the productive quality of the soil, ought to be considered by every planter who wishes to derive either profit or satisfaction from his labours; a barren heath, which has never sent forth of its own accord a single blade of grass, is not likely to produce either carrots or potatoes between the rows of trees; but it is a satisfaction to know, that the same land will produce no weeds, that the expense of hoeing and cleaning for three years together will be avoided; and that the plants of all descriptions may be put into the ground at an earlier age, and consequently at a cheaper rate, and in a state more likely to thrive. I cannot reasonably, at my time of life, look forward to any personal profit from these endeavours to convert a useless waste, of many hundred acres, into a valuable forest, but I may venture to hope that my example will be an encouragement to others, and that I may be thought not unworthy of some mark of the approbation of your patriotic society, which would not only reward my past labours, but stimulate me to future exertions.

The extent of fencing completed the same year amounts

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to fourteen hundred and thirty-five poles. Seven hundred and ninety-two poles are planted with two rows of quick.

Three hundred and eighty-four poles are sown with furze seed; four thousand oaks, four thousand sycamores, four thousand birches, and six hundred ashes are also planted in the banks at regular distances.

I have the honour to be,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. CHARLES FYSHE PALMER.

WE, the undersigned, believe the above to be a true and correct statement.

ROB. SMALLPEND } *Commissioners.*
RICH. CRABTREE }
H. WALTER, *Surveyor.*
H. ST. JOHN, *Rector of Finchemstead, Berks.*

February 20th 1819.

WE, the undersigned inhabitants of Wokingham, do certify, that we believe the foregoing statement to be correct; and that the plantations are now in a healthy and thriving condition.

JOHN ROBERTS.
JAMES WEBB.
WM. LANE.

The following is a general Summary of the Trees planted, viz.

Scotch firs	390,000
American oak	700
English oak	6,000
Sycamore	6,000
Black Italian poplar	5,000
Birch	3,000
Larch, four years old	5,000
Spanish chesnut	1,000

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Balm of Gilead fir.....	3,000
Oak, sycamore, birch, and ash, planted in the outside line of fence	12,600
Alders	21,000

N° IV.

MACHINE FOR WEIGHING AND BINDING HAY.

The SILVER ISIS MEDAL *and* FIFTEEN GUINEAS *were this Session conferred on* JOHN BECKWAY, *of Lewisham, Kent, for a* MACHINE *for* WEIGHING *and* BINDING HAY. *The following Papers have been received on the subject, and a Model of the Machine is kept in the Society's Repository.*

Lewisham, Kent,
January, 1819.

SIR;

I TAKE the liberty of sending herewith a model of a machine for weighing and binding hay, preparatory to its being sent to market, which I beg the favour of you to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce.

Whenever the Society may be pleased to command me, I shall be ready to attend for the purpose of explaining the manner of using the machine, and of affording any information the Society may require on the subject.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.
JOHN BECKWAY.

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CERTIFICATE.

We the undersigned do certify that we have seen and do highly approve of the machine for weighing and binding hay, invented and made by John Beckway, of Lewisham; by the use of which, all the trusses are made of equal weight, and the irregularities to which the common method is liable are avoided; and we do further certify, that we are so fully satisfied of its practical utility, that we have employed him to bind all the hay sold by any of us during the last two years, and shall continue so to do.

The said John Beckway has constantly been a servant and labourer in husbandry—is industrious and honest—he has been the sole contriver of the implement, and we strongly recommend it to the attention of the Society of Arts, Manufactures, and Commerce.

Abram Constable, *Lewisham.*
John Wilmot.
Wm. Edgerton.
Joseph Bradly.
Ambr^E Shove.
John Winton, *Senr.*
John Forster, *South End.*
James Thomas.
John Jackson.
Thomas Lane.
G. Phillips.
Edw. Owen, *Junr.*
Walter Anderson.
Thos. Denne.
Wm. Gooch.
Thos. Wallis.

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The object of Mr. Beckway has been, to construct a machine for weighing and binding hay, so simple and expeditious in its application, as to perform its business in no longer time than is required by the common method, in which only two or three trusses are actually weighed, and all the rest are made up by guess. The consequence of this is, that the labourer employed in this occupation, notwithstanding all his care, makes the trusses sometimes too heavy, to the loss of the seller, and sometimes too light, to the loss of the buyer, or discredit of the seller. The merit of Mr. Beckway's machine consists rather in the skilful combination of means already well known, than in the invention of new apparatus. The result, however, is, that though he weighs accurately every truss, he can get through one-sixth more work in a day than is usual. His charge is only the common price of 2*s.* 6*d.* to 3*s.* per load. The cost of the instrument is about 3*l.*

Mr. Edgerton, agent of J. Forster, Esq. stated to the committee, that J. Beckway has bound and weighed hay for him with his machine for two years and a half.

He sells from 200 to 300 loads annually, and before the machine was used, irregularities in the weight were constantly occurring, to the dissatisfaction both of buyer and seller. Since the use of the machine, no complaints whatever have occurred from either party. The trusses are bound even tighter than by the common way, and therefore take up less room in carriage.

Reference to the Engraving of Mr. BECKWAY'S *Machine, Plates* I *and* II.

Figs. 1, 2, pl. I, represent the machine dismounted, and packed (together with the other instruments used in conjunction with it) ready to be wheeled from one place to another.

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A, the wheel.

B, the frame, which, when inverted, forms the support of the machine, as shown fig. 4, pl. I.

C, the knife.

D, the fork.

E, the pin, fig. 11, pl. II.

F, the standard or fulcrum, fig. 5, pl. II.

G, the graduated bar, or lever, fig. 8, pl. II.

H, the weight, with its chain, fig. 10, pl. II.

I I, the frame or scale, on which the hay is placed, fig. 7, pl. II.

Fig. 3, pl. I, the wheel and the frame, the other parts of the apparatus being removed.

a, a staple through which the pin E passes, and is secured.

Fig. 1, pl. I, the frame B, turned upside down, and ready to form a support for the machine.

b b, two holes in which the lower end of the standard F is secured.

c, the handle, and *d*, the blade of the latch, which is a piece of iron bent to an angle, in which a pin is inserted, as a center of motion: hence, by moving the handle, the frame on which the truss of hay is placed may be fixed or released at pleasure, by the blade *d* passing into or being withdrawn from the hole *e*, fig. 7, pl. II.

Fig. 5, pl. II, the standard F: the lower part *f* is secured in the holes *b b*, fig. 4: *g* is the point of suspension for the knife-edges *h* of the lever, fig. 8.

Fig. 6, pl. II, a view of *g* at right angles to its position in fig. 5.

Fig. 7, pl. II, the frame I I, figs. 1, 2, pl. I, on which the truss of hay is placed. It is here represented as folded up for carriage; but in fig. 12, is shown occupying its proper position in the machine.

i i, the bed on which the truss lies.

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k k, hinges by which it is folded up for carriage.

l, a curved piece of wood, in the middle of which is a notch *m*, for receiving the short end *n* of the lever, fig. 8.

o o, figs. 7, 12, two notches in which the hay-bands are laid before the truss is placed on the bed.

Fig. 8, pl. II, the lever or steel yard, having the long arm divided in the usual manner. The hook, fig. 9, and the chain, fig. 10, form the weight, as shown in fig. 12.

Fig. 11, pl. II, an iron pin or spit E, which being thrust through the truss, prevents it from coming to pieces in removing it from the hay-stack to the machine.

Fig. 12, the machine put together, and ready for action.

The order in which the different parts of the process are to be executed is as follows:—first, unload the various articles from the machine, figs. 1, 2, and thus reduce it to the state fig. 3; secondly, detach the wheel, and turn the frame bottom upwards, fig. 4; thirdly, fix the standard; fourthly, lay the lever on the top of the standard, and then hang on the frame I I; fifthly, adjust the balance of the frame by hanging on the chain and weight; sixthly, fix the frame, by moving the handle *c* of the latch, and then move the hook of the weight to the division on the bar indicating the weight of the truss; seventhly, lay two hay-bands in the notches *o o*, and in the grooves on each side of the frame, as shown fig. 12; eighthly, place the truss on the frame, unlatch it, and take away, or add hay, till the just quantity is found; then latch the frame again, and secure the truss by means of the hay-bands. The truss being then removed, two other hay-bands are to be laid in the places of the former ones, and the second truss is to be made up as already described.

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N° V.

INSTRUMENT FOR GATHERING FRUIT.

The Sum of TEN GUINEAS *was this Session given to Mr.* THOS. LANE, *of Stockwell, for an* INSTRUMENT FOR GATHERING FRUIT.—*The following communications were received from him on the subject, and a Specimen of the Instrument is preserved in the Society's Repository.*

Chapel-street, Stockwell,
Nov. 3rd, 1818.

SIR;

I BEG leave to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce, a machine for gathering fruit either from wall trees or standards, but more particularly the latter. There are few trees of any magnitude, especially apple and pear-trees, of which all the fruit can be gathered by hand, even with the assistance of a ladder, and in the attempt many of the best bearing sprays are necessarily injured or torn off. The finest fruit also is that which grows at the ends of the highest branches, where it has the full advantage of the sun and air. But fruit in this situation is precisely that which is the most difficultly got at in the ordinary way of gathering, and hence much of the prime produce of a tree is either shaken or beaten to the ground, in consequence of which it receives so many bruises as to be unfit for market, and incapable of being kept. The instrument which I have the honour of laying before the

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Society is calculated to gather fruit without bruising it, and without injuring the branches in any degree. I have found it on trial to answer my expectation, and the subjoined certificate from Mr. Phillipps, Junr. confirms the result of my own experience.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. THOS. LANE.

CERTIFICATE.

Exhibition of Fruit Trees, &c.
Portsmouth Road, near Vauxhall,
Nov. 19, 1818.

SIR;

Mr. Lane left one of his fruit gatherers at my establishment the beginning of last Autumn, which I have used ever since, finding it very convenient for gathering apples, pears, &c.; have shown it to many persons who have approved of it.

I am, Sir,
&c. &c. &c.
L. PHILLIPPS, *Junr.*

Reference to the Engraving of Mr. LANE'S *Fruit-Gatherer. Plate* III, *figs.* 1, 2, 3, 4, 5.

a, a pole of white deal, or any other light stiff wood, ten or eleven feet long.

b, a bent lever, having the long arm turned up into a hook, and the short arm pierced with an eye at the extremity.

c, an iron wire one-eighth of an inch in diameter, secured in a longitudinal groove in the pole, as represented in the

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section fig. 4, and fastened at one end to the lever *b*, and at the other end to the lever *d*.

d, a bent lever, the long arm of which is terminated by a ring, fig. 3, over which a piece of leather is stitched, fig. 1.

e, a ring fixed to the pole by means of a stem, and placed directly opposite the lever *d*.

The ordinary state of the apparatus is that represented by the shaded parts of figs. 1 and 2. When it is to be made use of, the under side of the pole is to be grasped by the left hand, while the right hand is slipped within the hook *b*. The end of the pole being brought near the fruit, the right hand is to be raised so as to bring the hook *b* into the position represented by the dotted line; the short end of the lever will of course at the same time press the wire *c* forwards. The impulse of the wire throws the lever *d* into the position represented by the dotted line, and the interval between the two rings becomes such as readily to admit an apple or pear of the largest size. The hook *b* being now again brought nearer to the pole, the ringed extremity of *d* grasps the fruit gently but firmly, and a slight pull detaches it from the branch.

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N° VI.

BRITISH OPIUM.

The GOLD ISIS MEDAL *was this Session conferred on* JOHN YOUNG, *Esq. Fellow of the Royal College of Surgeons, Edinburgh, for his method of cultivating in Great Britain the* PAPAVER SOMNIFERUM, *and the preparation of* OPIUM *from it.—The following communications have been received on the subject, and Specimens of the Instruments described and referred to are placed in the Society's Repository.*

Edinburgh,
April 22, 1818.

DEAR SIR;

THE preparing of opium from poppies grown in Britain having engaged the attention of the Society for the Encouragement of Arts, Manufactures, and Commerce, I request you will do me the favour to present to the Society the inclosed account of a new method of collecting opium in this country, and a proposal for improving the present mode of gathering it in the East Indies. The box contains a specimen of the opium, the instruments used for collecting it, and one of the capsules from which I gathered it. I have affixed to the account two certificates respecting the efficacy of the opium.

I am, Sir,

A. Aikin, Esq.
Secretary, &c.

&c. &c. &c.
JOHN YOUNG.

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The natural history of opium, and the manner of collecting and preparing it in the East Indies and in Persia has been fully detailed by Dr. Samuel Crump, in his Inquiry into the Nature and Properties of Opium. He examined the different accounts related by authors, from Dioscorides, Pliny, Kæmpfer, and many others, till the year 1792, when his very interesting work was completed.

The preparation of opium in Britain has long been a desideratum. Premiums have been offered by the Society of Arts, and more recently by the Caledonian Horticultural Society. Specimens of British opium have been produced, and proved to be in no degree inferior to the best foreign opium; but it has not yet been ascertained that this valuable drug can be cultivated in Britain with profit to the grower.

The few experiments which have been made, were conducted according to the eastern mode. But the temperature, winds, and rain of this climate, have hitherto been justly considered as insuperable obstacles. Of these the temperature may be held as the least objectionable, for the large white poppy (*Papaver somniferum* of Linnæus), from which foreign opium is obtained, comes to maturity in this climate. But it is further objected, that the high winds beat down the plants, and the rains wash off the opium, before it can be collected, when the eastern mode of gathering it is practised. It has therefore been proposed to cultivate the garden poppy of this country, because it is not so liable to be damaged by wind as the large white poppy.

It is the object of this communication to describe a method by which these obstacles have been completely removed, and to demonstrate from the result of experiment, that opium, superior in quality to the best Turkey opium, can be procured in Britain, in sufficient quantity, not only for home consumption, but also for exportation. It is pro-

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posed to cultivate the poppy not only for its opium, but also for its oil; and it will appear that a crop of early potatoes may be raised upon the same space of ground, with the opium and oil by the same culture, and that such a crop will, in a good season, yield a clear profit of from 50*l.* to 80*l.* per acre, allowing 60*l.* for expenses.

The monopoly of the opium, produced from the culture of the poppy, is the third principal branch of the East India Company's *territorial revenue in India.**

In 1773, the contract or exclusive privilege for providing opium was granted to Meer Munkeer, in preference (as was stated by government) to any one else, because, being the person employed by the gentlemen of Patna in that business, he was the best acquainted with the proper mode of managing it, and would account for any outstanding balances. He was to deliver the Bahar opium at 320 rupees, and the Oude at 350 rupees per maund.

Since that time, the East India Company's annual revenue upon that article alone, has risen from eight to upwards of eighty lacs of rupees, or more than a million sterling. By a report, dated East India House, 29th February, 1816, which was at that time laid before parliament, the sale of opium in Bengal for the year 1813-14, amounted to 96 lacs, 40,729 current rupees, the advances and charges upon which, only amounted to 10 lacs, 77,638 current rupees.

But the opium used in Britain is principally supplied from Turkey. The gross amount of duty upon opium, imported into Great Britain in the year 1816, was only 2,651*l.* 13*s.*, while the average quantity consumed in Britain is 14,400 lb., which is chargeable with a duty of 8*s.* 8*d.* per pound. There are, besides, from 250 to 300 chests of opium imported from Turkey, and lodged in

* Parliamentary Reports, vol. vii, p. 23.

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bond warehouses for exportation, each chest containing from 150 lb. to 200 lb. of opium. This statement is from a member of the Turkey Company in London.

As the method of gathering opium, about to be proposed, differs materially from any other hitherto in use, it may be proper to observe, that Mr. Ball, who obtained a premium of fifty guineas from the Society of Arts, collected his opium according to the Bengal method, which is accurately described by Mr. Kerr,* who was an ocular witness, and by A. W. Davis,† whose accounts agree with that given by Kæmpfer ‡ respecting the mode of collecting opium in Persia. The seeds, according to Mr. Kerr, are sown in quadrangular areas, the intervals of which are formed into aqueducts for conveying water into each area. The plants are allowed to grow six or eight inches from each other, and are plentifully supplied with water till they are six or eight inches high, when a nutrient compost of dung, ashes, and nitrous earth, is laid over the areas. A little before the flowers appear, they are again well watered till the capsules are half grown, when the watering is stopped, and they begin to collect the opium. This they effect by making, at sunset, two longitudinal incisions from below upwards, without penetrating the cavity, with an instrument that has two points as fine and sharp as a lancet. The incisions are repeated every evening, until each capsule has received six or eight wounds, and they are then allowed to ripen their seeds. The juice which exudes is collected in the morning, and being inspissated to a proper consistence, by working it in an earthen pot in the sun's heat, it is formed into cakes for sale.

In this manner Mr. Ball collected four ounces of opium from one fall and twenty-eight square yards of ground,

* Medical Observations and Inquiries, vol. v, art. 28.
† Transactions of Society of Arts, vol. xvi, p. 273.
‡ Amœnitates Exoticæ, Fas. 3, Obs. 15.

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which is at the rate of 22 lb. 8 oz. per acre. But, in another place, he observes, that by a calculation which he made, supposing one poppy growing in one square foot of earth, and producing one grain of opium, more than 50 lb. will be collected from one statute acre of land. But if I take his proposition, and calculate by the rule used by land-measurers, the produce in that case would only be 5 lb. 11 oz. and 1 dr. per acre. If Mr. Ball's assertions with respect to the probable produce had been correct, there can be no doubt that opium would have been prepared in this country to a considerable extent.

It is probable that Mr. Thomas Jones, who was a candidate for the premium offered by the Society of Arts, was misled by the speculations of Mr. Ball. Mr. Jones only collected 21 lb. 7 oz. of opium from five acres and upwards of poppies, and obtained the premium of fifty guineas for the largest specimen. He collected his opium according to the Bengal method; but some of his poppies, he says, became stunted, and others were entirely destroyed by remarkably dry weather, which continued six weeks from the beginning of May. This may be considered as the reason why he obtained so little from five acres. In another place he says, the largest quantity which his man, seven children, and himself, were able to procure in one morning from 5 to 9 o'clock, was, one pound and a half. This happened when the dew was remarkably great, and succeeded one of the warmest days of the summer. And as he admits, in another place, that the opium (which appeared upon the heads in a soft ash-coloured substance), when first collected, is, from its union with the dew, much too soft to be formed into a proper consistence; making a proper allowance for the evaporation of its watery part, I conclude that he gathered only in one morning, after a warm day, in the same ratio that they gather opium in the East Indies. They have no rain

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in India during the season of gathering opium, and Mr. Kerr says, that there one acre of poppies yields 60 lb. of opium.

These observations, collected from Mr. Jones's paper to the Society of Arts, should be kept in view, as they may help to illustrate one of the objects of this essay, and confirm the superiority of my method of collecting opium in Britain.

Dr. Howison, who was for some time inspector of opium in Bengal, is the only other person, so far as I know, who has given an account of the result of his experiments for making opium in this country. Although he was not the first who collected the milky juice of the poppy in a fluid state, it is supposed he is the first who, in this country, has given the preference to that mode. Dr. Alston collected the milky juice in the fluid state according to Dioscorides,* and also in the Persian way described by Kempfer, from several varieties of the poppy. He also collected the true tear, as he calls it, by cutting off the star from several of the heads, bending them down, and suffering the milk to drop into a tea-cup; yet he says that he collected more by the Persian way than by that described by Dioscorides.

The instrument used by Dr. Howison for wounding the poppy-heads, consists of a brass ring, made to fit the middle finger of the operator, in which is fixed a wheel set with lancets, which, when put in motion by drawing the hand along the poppy head, makes with great expedition whatever number of perforations are wanted, each giving out its distinct drop of milk, by which a great surface is afforded both for support and evaporation, and the flowing milk is prevented from running upon the ground, *the unavoidable consequence of the method formerly in use.* And for gathering

* De Papavere sativo et sylvestri, lib. iv, cap. 65, p. 427.

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the opium, he employs a tin flask, flattened at the mouth about half an inch, with which he *scrapes* off the opium. By means of these instruments, Dr. Howison obtained a cake of opium that weighed 8½ oz., and which was collected from a field of poppies measuring about five falls, which is at the rate of 17 lb. weight of opium per acre.

Dr. Howison's puncturing instrument and collecting flask, may certainly be considered as a material improvement upon the Hindoo instruments, and he found that they answered his purpose to a certain extent in gathering opium from the garden poppy. But when the unevenness upon the surface of the capsules of the white poppy is considered, it will be found impossible to adapt the mouth of the flask so as to collect the whole of the juice without materially injuring the capsule, and much of the juice would still remain in the interstices of the ridges, which are for the most part found upon the capsules of the white poppy. Besides, the juice very soon acquires a ropiness, and adheres to the mouth of the flask, which must interrupt the gathering, and there is a chance of the juice being spilt by having the flask suspended to the body of the gatherer.

Dr, Howison has stated several objections to the cultivation of the large white poppy in this country, and has given the preference to the double red garden poppy and its varieties. He says that the white poppy, from its large head and very considerable height, is of all others the most liable to be hurt by winds; and unless they be cultivated in a sheltered situation, few will be found standing when the season for gathering the opium arrives, But independent of this, he says, that it never arrives at such perfection in this climate as to yield milk of proper consistence for making good opium, and that the few that do come to afford milk, continue in that state only for a day,

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and any attempt to bleed them a little sooner or later would be without success.

Mr. Kerr,* however, informs us, that the large white poppy grows in Britain, without care, to be a much statelier plant than it does in India with the utmost art; and Dr. Alston,† after commenting upon the controversy, whether opium is got from the white poppy or from the black, concludes that, as a medicine, it is of no consequence whether it be taken from the one or from the other. Dr. Crump also observes that the white variety is to be preferred, as affording opium in greater quantity than any of the rest, and there can be no doubt that this poppy yields the largest and most juicy heads.

Dr. Howison has stated that 200,000 lb. of opium are made annually in Bengal; and that notwithstanding all the care that is taken in collecting it, one third of the crop is lost; but there is reason to believe, that the waste is much greater than he supposes. For in whatever way the incisions are made, the milky juice instantly flows in a wasteful stream, and by running upon the ground or upon the leaves, one third of the crop at least must be lost before the gathering commences in the morning. In this climate, he remarks, where the serenest day is often followed by a night of deluging rain, the adoption of the Bengal method would be worse than trusting our fortune to the chance of a lottery.

Although Dr. Howison was convinced that the juice of the poppy undergoes no change in its properties by exposure to the air, farther than acquiring a greater consistence from the evaporation of its watery part, he states in another place, that in Bengal, where there is no rain during the opium gathering season, the custom of allowing the milk

* Edin. Med. Essays, vol. v, p. 103.
† Lond. Med. Observ., vol. v, p. 321.

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to thicken, by remaining for some time on the capsule, is highly judicious. While, in another part of his account, he admits that that custom is the only reason why they lose one-third of their crop.

Supposing that 200,000 lb. of opium give the East India Company 100,000*l.* sterling annually, by Dr. Howison's account they lose more than 30,000*l.* But were the loss only to amount to half that sum, sufficient importance, it is to be supposed, would be attached to the means by which such a saving could be effected.

Mr. Kerr states, that there are about 600,000 lb. of opium annually exported from the Ganges, independent of what is consumed in the interior. He also states, that it is frequently mixed with cow-dung, with the extract obtained by boiling the plants, and with other additions which are kept secret. It is, indeed, frequently so much adulterated, that considerable quantities are burnt at Calcutta by order of the government.

In the summer of 1817, I cultivated a small field of poppies, containing about 20,000 plants of the Papaver somniferum of Linnæus, out of which I selected two beds, measuring one fall and fourteen square yards, for the purpose of ascertaining what quantity of opium it would produce. I collected the opium from that part selected for the experiment myself, while the rest of the crop was gathered by the people I employed. I collected as much of the milky juice as was equal to 1 drachm of solid opium in the space of an hour; but as my professional avocations prevented me from regularly superintending the people at work, they did not gather so much as I expected. I ascertained, however, that they could gather at the rate of 1 drachm in the hour.

I had my poppies sown in three different ways. The first broad-cast upon beds three feet wide with an alley between, and thinned out to the distance of four and five

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inches, when the plants were about two inches high above the ground. The second on beds three feet wide, in rows, six rows to a bed, and six inches between the plants. The third on the spaces between rows of asparagus, two rows of poppies on each space, eight inches between each row, and six inches between the plants; two feet four inches between each double row of poppies being occupied by the asparagus.

The first produced only one capsule, the second two, and the third three capsules per plant.

Having ascertained that the white poppy, when cultivated upon the wide drill plan that I have adopted, not only yields more capsules, but much larger ones than when cultivated in the broad-cast way, or in close rows: it is evident there must be a great saving of labour, for it will take as much time to gather the juice from a small head, as it would do to collect three times the quantity of juice from a large head.

The plants between the asparagus rows having more room to grow, had not only more capsules, but they were much larger than those sown broad-cast, or in beds in close rows; and as early potatoes, cultivated in a piece of ground adjoining my crop, were sold for a high price before my plants began to flower, I proposed the following year to have, by this mode of culture, the same quantity of opium with a crop of early potatoes, as I obtained from an equal measurement of ground, where there was nothing but poppies.

Accordingly, in 1818 I selected a piece of ground in the highest state of cultivation, well manured with horse-dung, in which I planted early potatoes, in rows four feet wide. Furrows were first drawn; in these furrows the dung was laid; then the sets were dropped on the dung, about nine inches asunder, and covered by the hoe. The potatoes were planted the first week of February;

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and the poppies were sown about the middle of April, on the middle space between the potatoe rows, two rows of poppies on each space, and twelve inches between the rows. When the poppy plants were about two inches above the ground, they were at first thinned out by the hoe, and afterwards by the fingers, to the distance of eight inches between the plants.

In this manner I raised a crop of early potatoes equal to 36 bolls per acre. Although the potatoes will be ready for immediate use before the gathering of opium commences, the whole crop will not be entirely ripe for lifting till after the opium is collected. The early potatoe gives out but a small stem, but where the soil is rich, some of them may spread in the areas, yet they can be easily pushed over to one side, so as to allow the opium gatherers to walk along the areas without trampling upon them.

The distance between the poppy plants being wider than last year, upon an average they produced four full grown capsules each, and some of them produced seven or eight capsules; and I gathered this season at the rate of two drachms of solid opium in one hour, while, by the same method of gathering, I could not collect more than one drachm in the same time last year.

Supposing one acre had been cultivated in the same manner as that piece of ground on which my experiment was made, the produce in that case would have been equal to 57 lb. 9 oz. 4 dr. and 48 gr. of solid opium, which is just twice as much as I collected the year before. But the season of 1818 being so much more favourable than the preceding year, will in a great measure account for the success of this experiment. Therefore the quantity of opium that may be collected depends greatly upon the season; yet the comparative view of the result of the experiment made in 1817, although the season was ex-

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tremely unfavourable, is sufficient to prove that my method of extracting and gathering opium has a decided advantage over any other that has been recommended.

As my poppies were sown about the middle of April, they were ready for bleeding about the middle of July.

The instrument which I used for making the incisions consisted of two convex edged scalpels, the blades of which were covered with sealing wax, except about one-sixteenth part of an inch of the edge, and being wound round the handles with waxed thread, the two were fastened together with other thread twisted round them, and thus held at the distance of about half an inch between each blade, (pl. III, figs. 6 and 7). It is obvious that the blades are covered with sealing-wax for the purpose of preventing the knife from penetrating the cavity of the capsules; and it can be easily removed and applied again, when the knives require to be sharpened: or the blades may be mounted with a metal sheath or guard for this purpose.

With this instrument I make one or more double incisions, according to the size of the head, at first longitudinally, and afterwards obliquely upwards from the stalk, (fig. 10).

When the capsule is sufficiently scarified in the manner described, I then cut off, with a sharp scalpel, the capitellum or star, with a thin slice of the external rind round it, (*a c*, fig. 10); and by this last incision I obtain more juice than from a scarification upon the side of the head.

It is my method of gathering the milky juice of the poppy in the fluid state, that differs materially from any other that has been used, and it is on that account that I have been more successful than any other that has tried the experiment.

In my communication to Dr. Duncan relative to Lactucarium or Lettuce-Opium, published in the second edition of his Observations on Pulmonary Consumption, I proposed to gather the opium by means of a sponge

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But when I began to collect opium in that way, I soon found that it would not do; for although the sponge removes the juice more effectually than the flask proposed by Dr. Howison, it cannot be again entirely expressed, because the sponge decomposes or separates the component principles of the milky juice, and the resinous part adheres to the sponge, and soon clogs its pores. I therefore adopted the use of a small common hair-brush used by painters, and known to the trade by the name of Sash-tool (pl. III, fig. 8), which answers the purpose most completely, and with which I gathered the milky juice, even though some of the plants were laid by wind and rain, as well as if they had been standing erect. I used a camel-hair brush, but found the same objection to it as to the sponge. The common sash-tool, rounded a little at the point, without being ground, is that which I prefer.

For the sake of experiment, I exposed myself one morning to a shower of rain for half an hour, while making the incisions and gathering the opium, and succeeded as well as when there was no rain, without any other inconvenience than being wet, and having an additional quantity of water with the opium.

When the brush is sufficiently charged with juice, I scrape it off upon the slip of tin *b*, fig. 9, fixed in the mouth of a tin flask, fastened to the breast of the gatherer by straps through the holes *a a*, and capable of holding more than a day's gathering.

The gatherers follow the bleeders immediately. One bleeder will occupy two gatherers, and if he be very expert at using the knife, he may keep three gatherers constantly employed. When I performed both operations myself, I held the knife between the thumb, fore and middle fingers, and the brush between the ring and little fingers of the right hand, while I held the poppy by the stalk with the left hand.

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The juice is afterwards formed into cakes or balls by spontaneous evaporation in shallow earthen dishes, placed in a close room, stirring it occasionally during the evaporation of its watery part, to be afterwards kept in bladders.

The operation for gathering cannot be repeated with advantage oftener than three times a week, upon the same capsules, for no more juice will flow from one wound than what may be collected immediately, and a certain time must elapse before the plant forms more juice. But it is evident a number of hands may be kept constantly employed upon a large field, till the plants cease to give out juice.

One acre will keep twelve gatherers and six cutters constantly employed for thirty days. That number can only gather a third part of an acre in one day, and by the time they have gone through the crop, the capsules at that place where they began to gather, will be ready for the operation being repeated. So that when the milky juice ceases to flow, five operations, as already described, will have been made upon each capsule.

Supposing twelve gatherers to work ten hours in the day, and that each gathers two ounces and a half, or as much of the juice as will make that quantity of solid opium; in thirty days they will gather fifty-six pounds of opium from one acre.

One acre of poppies cultivated according to my method, will yield 1,000 lb. of seed, and this quantity of seed will give by expression 375 lb. of oil.

Although the produce of such a crop has not yet been clearly ascertained upon a large scale, the following may be taken as the estimate of one acre, from what has actually been produced in my experiment.

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Estimated value of the produce of one acre,	*l.*	*s.*	*d.*
56 lb. opium, at 36*s.*	100	16	0
36 bolls early potatoes, at 24*s.*	43	4	0
250 lb. of oil, cold drawn, at 1*s.* 6*d.*	18	15	0
125 lb. ditto warm, at 6*d.*	3	2	6
500 oil cakes, at 18*s.* per 100	4	10	0
	170	7	6
Expenses	60	0	0
Total of profit	110	7	6

Or it may be taken this way,

56 lb. opium, at 17*s.* 6*d.*	49	0	0
36 bolls of potatoes, at 24*s.*	43	4	0
250 lb. of oil, cold drawn, at 1*s.* 6*d.*	18	15	0
125 lb. ditto warm, at 6*d.*	3	2	6
500 oil cakes, at 18*s.* per 100	4	10	0
	118	11	6
Expenses	60	0	0
Profit	58	11	6

Opium costs the wholesale druggist in London at this time (May, 1819) 17*s.* 6*d.* per lb., which, with a duty of 8*s.* 8*d.* per lb., makes it 1*l.* 6*s.* 6*d.*, and they charge the apothecaries 36*s.* per lb., which is the present London price of the article. The London price of opium varies so much, that about twelve years ago, it was as high as 84*s.* per lb., and it seldom falls so low as 24*s.*

If the crop can be got off the ground by the middle of August, it is proposed to have a second crop of potatoes or turnips, which will give, it is supposed, about 30*l.* more.

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Comparative View of the experiments of Messrs. Ball, Howison and Young, for ascertaining what quantity of Opium might be prepared in Britain.

	lb.	oz.	dr.	gr.
Mr. Ball, from 576 square feet, or 1 fall and 28 square yards, obtained about	0	4	0	0
Dr. Howison from about five falls, obtained	0	8	4	0
In 1817, from 1 fall and 14 square yards, containing 1,800 plants, I obtained	0	4	0	0
According to Mr. Ball's method, 1 fall produced 2 ounces and 2 drachms, or per acre	22	8	0	0
According to Dr. Howison's method, 1 fall produced 1 ounce, 5 drachms, and 36 grains, or per acre	17	0	0	0
By my method, 1 fall produced 2 ounces, 7 drachms, 2 grains, and $\frac{2}{5}$, or per acre...	28	12	6	24
In 1818, from 1 fall I obtained 5 ounces, 6 drachms, 4 grains, and +, or per acre	57	9	4	48

CERTIFICATES.

Edinburgh,
Dec. 22, 1817.

DEAR SIR;

During the course of last summer I repeatedly visited your plantation of poppies, for the manufacture of opium, in the neighbourhood of Edinburgh.

I admired very much the method that was followed for collecting the opium from the plants. For, by your plan, the very great inconvenience, which arises from the unsteadiness of our climate, if the Bengal method of collection, recommended by Dr. Howison in the Memoirs of the Caledonian Horticultural Society, be adopted, is completely obviated.

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I have lately prescribed your opium to many different patients, both in private and hospital practice, with the best effects. I have particularly prescribed what you put into my hands to several patients in the clinical wards of the Royal Infirmary, and, as I was inclined to infer from its appearance, I have found it remarkably efficacious, in no degree inferior to the best Turkey opium. I have, therefore, no doubt in considering your plan as an improvement in the arts, which may be adopted with great advantage in Britain.

I am, Sir,

John Young, Esq. &c. &c. &c.

Surgeon, Edin. ANDREW DUNCAN, *Senr. M. D. P.*

Physician, Edin.

Royal Infirmary, Edinburgh,

DEAR SIR; April 20, 1818.

During the last year I have frequently administered the opium made by you to patients in the Royal Infirmary, and it gives me much pleasure to report to you, that I have found it produce the same effects as the best foreign preparation of the medicine, and I think that a smaller quantity is necessary than of the foreign opium.

I am, Sir,

John Young, Esq. &c. &c. &c.

Surgeon. A. GILLESPIE.

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N° VII.

IMPROVED CHURN.

The Sum of FIVE GUINEAS *was this Session presented to* EDWARD ROBERTS, *of Hartsheath, near Mold, Flintshire, for a* CHURN.—*The following communications have been received on the subject, and a Model of the Invention is preserved in the Society's Repository.*

Leeswood, near Mold, Flintshire,
July 27, 1818.

SIR;

A model of a churn has been forwarded this day from Chester to the Society for the Encouragement of Arts, Manufactures, and Commerce.

It is invented by Edw. Roberts, of Hartsheath, an honest and industrious man, with a large family.

Any reward which the Society may be pleased to confer on a machine likely to be of considerable advantage to the dairy farmer, will be well bestowed and thankfully accepted.

I am, Sir,
&c. &c. &c.
T. W. EYTON.

A. Aikin, Esq.
Secretary, &c. &c.

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CERTIFICATE.

We do certify that the Churn invented by Edward Roberts, of Hartsheath, in the parish of Mold, in the county of Flint, a model whereof is sent to the Society of Arts, &c. by waggon, is used by us in our dairy, that the machine performs its operation in a more expeditious and perfect manner than any we are acquainted with, and we conceive it to be an invention worthy the notice of the agricultural interest of the country.

Signed by us this 25th day of July, 1818.

Hope Wynne Eyton.
Wm. Ingleby.
John Jones.
William Jones.
John Jones.
Wm. Wynne.

Reference to the Engraving of Mr. Roberts's *Churn, Plate* IV.

Figs. 1 and 2. Views of the churn, in nearly opposite directions.

Fig. 3. Section of the barrel of the churn.

4. The cover of the barrel.

5. Shows the connexion of the beaters with the moving power.

a, the barrel.

b, the handle of the cover.

c c, (fig. 4) ellipsoidal holes in the cover, through which the beaters pass.

d d, (fig. 1.) loose covers for the holes *c c*, to prevent the liquor from being dashed out of the churn, when the beaters are at work.

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e, (figs. 1 and 4) a round hole in the cover for the purpose of admitting air into the churn, and capable of being closed at pleasure, by the button *f*.

g g, the beaters or staves, attached to sockets of iron *h h*, in each of which is an eye *i*, through which a pin passes, and thus connects the beaters with the moving power.

k k, two levers, having the axis *l l*, fig. 2, for their fulcrum, connected at one extremity *i* with the beaters, and at the other with two short arms *m m*, which arms are themselves connected by loops at their other extremity with the double-cranked axle *o o*, fig. 2.

p, (fig. 2) a winch, fixed on one end of the double-cranked axle.

q, a fly wheel fixed on the other end of the axle.

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PAPER

IN

CHEMISTRY.

ANATOMICAL PREPARATIONS.

The SILVER MEDAL *of the Society was this Session voted to* W. COOKE, *Esq. of London, Fellow of the Royal College of Surgeons, for the successful preservation of* ANATOMICAL PREPARATIONS, *by means of a solution of muriate of Soda.—The following communications have been received from him on the subject.*

Great Prescot Street,
Jan. 2, 1817.

SIR;

TWO or three months ago, you obliged me by stating the means of access to the Society of Arts, of which I now avail myself. Six specimens accompany this letter. They are all dated when prepared. The fluid containing the eye is very turbid. It was carried about a year ago to Sir Joseph Banks, and by this means washed off some of the pigment of the choroid coat, part of which has fallen on the membrane hyaloidea, and much discoloured it. I might have sent more perfect specimens, but as this is of oldest date, I presumed on the indulgence of the Society,

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that the explanation I have offered would be accepted. At the top of the portion of stomach acted on by opium, some gaseous bubbles appear; they were extricated soon after the preparation was put up, and by being entangled between the talc and cellular substance, were irremovable without opening the bottle. At the bottom of the specimen of ulcerated intestine, are some unsightly pieces of window glass. When they were applied it was intended to change the bottle, but this I have not had an opportunity to do: some neat pieces of white glass applied in a similar manner, answer equally well with talc, the substance usually employed in spirit, and give the structure a more natural appearance.

I have tried the solution on brain, on which it is successful. I have by me large specimens of other parts, as the thoracic viscera of a child, æt. 2 years, which has been put up 15 months; the thoracic and abdominal viscera of a child, æt. 3 years, which has been put up 7 months; placentæ, &c.; in all of which (though they have not been accurately closed) the preservation is perfect, and no disagreeable odour is emitted.

It is needless to specify the advantages derivable from the adoption of a solution which costs only about 10*d.* per gallon, instead of a spirit, which, being somewhat above *proof*, costs 18*s.* or 20*s.*, provided its equal efficacy can be established.

To assert the benefits deduced from anatomical investigation, and from the preservation of natural and morbid structures, and the consequent importance of giving the utmost facility to these pursuits, would be an improper intrusion on the Society; yet, perhaps, the extent to which it is intended to vindicate the power of muriate of soda in solution, should be distinctly declared.

The muriate of soda, when dissolved in clear water, and filtered, constitutes a solution as bright as any can possibly be.

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When used a little below saturation, it will preserve animal substances an indefinite period, at all the temperatures of our atmosphere.

When animal substances have been properly macerated, and put into this solution, the solution will retain its brightness as long as it is excluded from the atmosphere; and will rarely deposit even nearly as much precipitate as is done by spirit of wine.

It may be used upon a large scale in vessels less accurately closed; upon specimens of any bulk, for occasional inspection; for which the costliness and volatility of spirit almost wholly unfits it.

It may be substituted for spirit almost universally; and there are some parts which it preserves in the natural condition, which spirit contracts.

The salt used in most of the preparations was that of Phillips London, Esq.; but some trials recently made, justify the assertion that common salt will avail, if conducted in the manner I have already detailed. [See Med. and Phys. Journ. for March, 1817.]

Mr. Bell, surgeon dentist, and lecturer at St. Thomas's Hospital, called on me last summer in consequence of the paper I had published. He saw my specimens and process; he adopted the process with common salt, and informed me last night that it fully answered. Some parts he had preserved in spirit for comparison, enabled him to say decidedly the solution of muriate of soda was preferable in a great degree.

The chief difficulty that presented itself in the manipulations, consisted in closing the bottles—to adopt a body which should be efficient and not liable to chemical action with the muriate. At length, glass, with a medium of resin, occurred to me, and proves easy of application, neat, and effectual.

Having been informed by you that should it meet the

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Society's approbation, my personal attendance will be required, I shall defer entering more fully into the process, which, indeed, is now before the public in the work referred to above.

I am induced to intrude upon the Society, because the article referred to did not meet with that attention which the subject appeared to deserve. Prejudice existed against it, because some anatomists had tried the muriate of soda without success; and probably because the fluid was so accessible, this prejudice might be strengthened. The best attestation will be the specimens themselves; and should it meet the important sanction of your Society, it will give me a more cogent appeal to the credence of my professional brethren.

The specimens have been submitted to the inspection of many respectable practitioners and chemists, who concur in asserting, that having stood so long, there is no prospect of future change.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. Cooke.

Prescot Street,
Jan. 5, 1817.

SIR;

I am sorry my former letter did not go sufficiently into detail to prevent you the trouble of writing to me. I beg, however, to thank you for having so early informed me the extent of information which is required by the Society.

When my paper was sent to the Medical and Physical Journal, the experiments had been about 8 months under management, and as I was anxious to exonerate myself from any design of exciting unwarrantable expectations, the preparations were individually described, and some points were alluded to, with respect to which success was

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doubtful, but which have since been fully decided in favour of the solution. I shall, therefore, relate my process quite independently of that article; nothing I have now to state will be in opposition to it, but the general results will be much more favourable than were at that time deduced.

The process is exceedingly simple; and when I have said that it consists in putting animal substances (deprived of their blood by maceration in water) into a saturated solution of muriate of soda, nearly the whole is comprehended. Yet, as I believe the transparency of the fluid, and the permanency of the preservation depend upon some trivial parts of the management, I shall give the particulars.

I keep a saturated solution of muriate of soda in good spring water. Every gallon of water dissolves about three pounds of salt.

The specimens intended for preservation are macerated in water, frequently changed, to deprive them of the colouring part of the blood, which usually occupies three or four days, or more, if the substances are large. I then place them in a solution of salt, kept in a common receptacle, to saturate them with the salt; and, as the water suspended in the animal structure would reduce the strength of the solution, this is counteracted by placing in it a linen bag filled with the muriate. It is kept in a linen bag to prevent the foreign matters of the salt from soiling the preparations. At the expiration of a few days they may be transferred from this vessel, into that bottle of solution which is to contain them permanently, or they may remain in the intermediate vessel as long as conveniency may require. The solution in which they are finally to be kept, should be a very little below saturation. Evaporation is much less liable to happen than if spirit is employed; yet should it occur, from any accident, crystallization would result, unless this

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precaution were adopted. I have added about half an ounce of very clear water to a quart of the saturated solution.

All kinds of animal structure do not exhibit the same relative gravity when saturated with the solution; some will float whilst others sink. In the final operation of preservation, the latter undergo the same treatment as is adopted with spirit, viz., by supporting them with delicate threads of silk; but the former require some *body* to give them an increase of gravity.

In almost all preparations it is requisite to keep certain parts separated by means of quill, bristle, or other insoluble substance; instead of these, I use delicate pieces of glass, which may be obtained from the glass-blowers of every degree of fineness. These answer fully; they look neater than any thing else; can be applied with great facility; render sufficient weight, and are of very little cost; for a few pence I purchased enough to last some years. In the specimen of ulcerated intestine, the glasses applied, as stated in the former letter, were not intended to be permanent; I had not then procured the glass from the manufacturer. Membranous parts it is customary to spread on talc, as two of the specimens are applied now with you. I think, however, by suspending a fine cylinder of glass at the bottom, the part retains a more natural appearance; and, therefore, of late, I have entirely relinquished the talc.

When the specimens are put into a solution of proper strength, and perfectly transparent, and the parts properly separated, to exhibit the different objects it is designed to show, the next point of importance is, to close the bottles with accuracy and neatness.

For the reasons already stated, glass, with a medium of resin, was chosen. I make the rim of the bottle perfectly dry, and spread on it some resin, with a common spatula.

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The glass (previously fitted) is then applied, and by holding the warm spatula pretty close to it, the resin softens, and the top is fixed with the utmost accuracy. I have thought it best to conduct this process in a moderately warm room, and the glass should be rather less than the circumference of the rim, or on lifting the bottles by the top, as is very generally done, the glass might be raised. With small bottles it is sufficient to make the resin smooth, and then varnish it; but on bottles of a larger size, additional security is obtained by attaching a slip of bladder around the edge, by means of glue.

When the diameter of the bottle is large, the glass top is liable to break after two or three weeks; by using the *eye* of the glass, I have found them perfectly safe, with a diameter of 4 inches; and for larger I have not had occasion.

In addition to the specimens mentioned in my former letter, I might have named fœtuses at the full period of gestation.

Having been accustomed to put up anatomical preparations, I do not hesitate to affirm that the method I have now detailed, is as easy of application as any other in popular use; and I believe 10*d.* per gallon would not only pay for the salt, but all the other little expenses, with the exception of the bottle.

Many parts of morbid structure are preserved much better than by spirit.

I cannot tell how far the specimens sent to the Society were rendered turbid by the shaking of the coach; although I hope, from your note, they did not sustain material injury.

The ulcerated intestine is a very good specimen of the disease, and is exhibited I believe better than it would have been on talc.

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The portion of heart, with open foramen ovale, was from an adult, and the fluid containing it was remarkably bright and colourless, which, I believe, would not have been the case, had it been in spirit. At two points the glass cover, in the act of putting it up, cracked, in consequence of a little accident; but they have not extended in the least.

The stomach affected by opium, exhibits exactly the appearance when taken from the body. I have not seen another specimen of the same condition, but suspect that spirit would not have preserved it.

The portion of intestine, with scrofulous mesenteric glands, exhibited the valvulæ conniventes, and all the natural and morbid characters very beautifully.

The digested stomach I sent because it was injected with size and king's-yellow, it could not be otherwise than *imperfect* in that condition of stomach; but it is sent to show that the solution has no influence on the colour of the injection.

I have never seen any preparation in spirit which has exhibited the membrana hyaloidea, &c. of the eye so beautifully as is done in the solution.*

I have tried some injections with size and vermillion, but not satisfactorily;—the trials I have made, induce, however, a strong hope and belief that they will remain in it unimpaired.

* This specimen has been placed by Mr. Cook in the Repository of the Society, and is now (Nov. 1, 1819) in perfectly good condition.

A. A. Sec.

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There do not occur to me any other particulars which may be considered needful.

A specimen of stomach, acted on by arsenic, which I have by me, retains the morbid characters very strikingly. It was a specimen exhibited to Sir Joseph Banks about a year ago, and left for some time at his house. When I called upon him afterwards, he said it had been shown to several anatomists, and was approved. He also condescended to allow me to express his approbation in the paper which I was then preparing for the Medical Journal.

I am, Sir,
&c. &c. &c.
W. Cooke.

A. Aikin, Esq.
Secretary, &c. &c.

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PAPERS

IN

POLITE ARTS.

N° I.

LITHOGRAPHY.

The SILVER MEDAL *of the Society was voted this Session to Mr.* C. HULLMANDEL, *of Great Marlborough Street, London, for the best Specimens of* LITHOGRAPHY, *executed on German Stone. The Specimens remain in the Society's Repository, and the following communication was received from Mr.* H. *on the subject.*

51, Great Marlborough-street,
Feb. 28, 1819.

SIR;

THE drawings I have the honour to present to the Society for promoting the Arts, Manufactures, and Commerce, are the fruits of an art invented some years ago in Germany, and but lately introduced in this country, at least, in its present state of perfection. Its great advantage is that of enabling the artist to offer to the public the original pro-

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ductions of his pencil, without having recourse to engravers. The repeated failures I met with when I first began the work, intituled "*Twenty-four Views of Italy*," determined me to have a press and materials of my own, and after several failures and renewed attempts during the space of fourteen months, I am at last enabled to offer some drawings which show, I hope, a decided progress in the art. I must beg leave to observe, that the twelve last of the 24 Views of Italy, and the 5 drawings marked 1, 2, 3, 4, and 5, are printed entirely under my direction, and that the preparation of the stones, the chalk, the ink, &c. are entirely done by myself. With regard to the drawings marked 6, 7, 8, 9, the whole process, from the first preparation of the stones, as well as the *printing*, are done also by myself.

It is much to be regretted that no good stones have hitherto been found in England. The only sort which answers tolerably well the purposes of lithography is the white lias of Bath, but it is of too soft and porous a nature, and gives but few impressions compared with what one can obtain from German stones. The Bath stones, however, answer very well for transfers, and other inferior productions. The decided superiority of German stones over any other, added to the difficulties I met with in obtaining a *pure* Bath stone of sufficient dimensions, have hindered me from producing a drawing done upon an English stone. All those I have the honour of offering, are printed from German stones, from the quarries of Solnhofen in Bavaria.

The art of Lithography admits of many different styles, such as ink drawings, either by lines or dots, etchings or engravings, chalk, and imitations of wood-cuts, and of acqua tinta. The only style, however, which has a decided superiority, is that of chalk, as I think no style of copper-plate engravings can give so perfect an imitation

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of original pencil drawings; whereas, from the natural tendency the stone has to imbibe the lithographic ink, it is impossible to obtain very fine lines, or any drawings which might not be executed with more ease by etching on copper. Very fine lines, and good imitations of copper-plate engraving may be produced by engraving upon stone; but as it requires almost as much practice as engraving upon copper, the chief advantage of lithography, viz. enabling an artist to execute his own drawings, is lost; to which must be added the disadvantage of the great bulk and weight of the stones, which must always hinder a person from laying by engravings already executed, as can be done with copper-plates. Transfers upon stones, however, with regard to writing, are extremely useful; it has also been attempted with copper-plate prints, but they are but poor imitations of the originals. The art of transferring writing upon stone is so very easy and simple, that I have thought it useless to offer any specimen of it. These considerations have led me to turn all my thoughts towards chalk drawings, and it appears lithography has been considered chiefly in that light both in Paris and at Munich.

The stones proper for lithography must be of a calcareous nature, pure, hard, and of a fine grain. They must imbibe both moisture and grease with equal avidity: on this is founded the whole art of lithography.

The chalk is a composition of grease, wax, shell-lac, soap, and black. The lithographic ink is composed of the same materials, but rather softer.

The stone must be rubbed down with fine sand to a perfect level, after which, it is ready to receive the drawing; when the latter is executed, a weak solution of nitric acid is thrown over the stone: this operation slightly corrodes its surface, and disposes it to imbibe moisture with more facility; while the stone is still wet, a cylinder of about 3

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inches in diameter, and covered with common printer's ink, is rolled over the whole surface of the stone; the wet part, of course, refuses to take the ink, while the chalk, being greasy, takes a portion of it from the roller. The stone is now ready for printing. The press consists of a box drawn by a wheel under a wooden scraper, pressing on it with great power; after the first impression, the stone is wetted afresh, again rolled over with the cylinder, drawn under the scraper, and so on. The same process is employed for ink drawings, except that the solution of aqua fortis must be stronger, and the printing ink stiffer.

Transfers are made either with chalk or ink, or with both together, on a prepared paper, which is then put damp in the press on the surface of a stone, and thrown off on it; the stone is then treated as a chalk or ink drawing. The tints of the prints marked 6, 7, 8, 9, are produced by a second stone covered over with grease; the lights are scraped out in the places where they are intended to be; and the print being brought on the stone in its exact place, produces the effect of a drawing on coloured paper touched in with white. The drawings marked 7, 8, 9, are printed with a third stone, to give more effect to the fore ground.

Imitations of wood-cuts are produced by covering the stone with lithographic ink, and scraping out the intended lights; and as the finer touches may be added with a hair pencil, prints far superior to wood-cuts may be obtained; but the chief advantage of wood-cuts, viz. printing them at the same time with the text of the book, is lost.

Engraving upon stone is performed by polishing the stone, and covering it with a thin coating of gum and black; the part intended for the drawing must be scraped out, and when finished, of course, appears white instead of black; the thicker lines, as in copper, must be cut deeper and when the whole is finished, the stone is rubbed with

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linseed oil, which not being able to penetrate the coating of gum, only touches the stone where it is scraped away. The gum is then washed of, and the print obtained as in the other styles of printing.

The imitations of acqua tinta are produced by several stones coinciding with each other, and producing a succession of flat tints, as in the drawings 6, 7, 8, 9. Drawings may also be done by mixing ink with chalk, and adding flat tints.

I am, Sir,

A. Aikin, Esq. &c. &c. &c,

Secretary, &c. &c. C. HULLMANDEL.

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N° II.

LITHOGRAPHY.

The SILVER ISIS MEDAL *was this Session voted to Mr.* D. REDMAN, *of Maiden Lane, for a Specimen of* LITHOGRAPHY, *a view on the Wye, executed on English Stone.—The following is an Extract from his communication on the subject.*

33, Maiden-lane.
Covent-garden.

SIR;

THE stone on which the accompanying specimen is executed was taken from a quarry, the property of Wm. James, Esq. of Warwick, a member of the Society for promoting the Arts, Manufactures, and Commerce. It is situated at Wilmcots, near Stratford-on-Avon, and the stone may be there procured in any quantity, and of a very large size. I can say from experience (having been some years in practice as a lithographic printer, in which time I have tried various English stones) that it is equal to the German stones in texture and hardness, and is capable of receiving any kind of drawings intended for lithographic purposes.

I am, Sir,
&c. &c. &c.
D. REDMAN.

A. Aikin, Esq.
Secretary, &c. &c.

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N° III.

IVORY PAPER.

The Sum of THIRTY GUINEAS *was this Session voted to Mr.* S. EINSLE, *of Strutton-Ground, Westminster, for the communication of his method of making* IVORY PAPER, *for the use of Artists. Specimens of the Paper are placed in the Society's Repository, and the following is an abstract of the information communicated to the Committee on the subject.*

THE properties which render ivory so desirable a substance for the miniature painter and other artists are, the evenness and fineness of its grain, its allowing all water colours laid on its surface to be washed out with a soft wet brush, and the facility with which the artist may scrape off the colour from any particular part, by means of the point of a knife or other convenient instrument, and thus heighten and add brilliancy to the lights in his painting more expeditiously and efficaciously than can be done in any other way.

The objections to ivory are, its high price, the impossibility of obtaining plates exceeding very moderate dimensions, and the coarseness of grain in the larger of these; its liability, when thin, to warp by changes of the weather, and its property of turning yellow by long exposure to the light, owing to the oil which it contains.

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The candidate produced before the Committee several specimens of his ivory paper about an eighth of an inch thick, and of superficial dimensions much larger than the largest ivory: the surface was hard, smooth, and perfectly even. On trial of these by some of the artists, members of the Society, it appears that colours may be washed off the ivory paper more completely than from ivory itself, and that the process may be repeated three or four times on the same surface, without rubbing up the grain of the paper. It will also, with proper care, bear to be scraped with the edge of a knife without becoming rough.

Traces made on the surface of this paper by a hard black-lead pencil are much easier effaced by means of India rubber than from common drawing paper, which circumstance, together with the extremely fine lines which its hard and even surface is capable of receiving, peculiarly adapts it for the reception of the most delicate kind of pencil drawings and outlines.

An artist of eminence in miniature painting (not a member of the Society) stated, that he has frequently used the ivory paper, and finds it to be superior to ivory itself in the whiteness of the surface, in the facility with which it receives colour, and in the greater brilliancy of the colours when laid on, owing to the superior whiteness of the ground. Colours on ivory are apt to be injured by the transudation of the animal oil, a defect which the ivory paper is free from.

Some highly respectable dealers in drawing materials stated, that they have had samples of the ivory paper in their possession for a considerable time, and that it does not appear to become yellow or discoloured by keeping.

The valuable properties of the paper appearing thus to be satisfactorily established, a day was fixed for the candidate to disclose his process, and to prepare a specimen

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of the paper in presence of the Committee. Accordingly, at the appointed time, Mr. Emsle attended, and exhibited before the committee his method of preparing the paper: he also gave in a written account of the process, from which, and from the information obtained during the sitting of the committee, the following account has been drawn up:—

Take a quarter of a pound of clean parchment cuttings, and put them into a two-quart pan, with nearly as much water as it will hold; boil the mixture gently for four or five hours, adding water from time to time to supply the place of that driven off by evaporation; then carefully strain the liquor from the dregs through a cloth, and when cold it will form a strong jelly, which may be called size (No. 1).

Return the dregs of the preceding process into the pan, fill it up with water, and again boil it as before for four or five hours: then strain off the liquor, and call it size (No. 2.)

Take three sheets of drawing paper (outsides will answer the purpose perfectly well, and being much cheaper, are therefore to be preferred), wet them on both sides with a soft spunge dipped in water, and paste them together with the size (No. 2). While they are still wet, lay them on a table, and place upon them a smooth slab of writing slate, of a size somewhat smaller than the paper. Turn up the edges of the paper, and paste them on the back of the slate, and then allow the paper to dry gradually. Wet, as before, three more sheets of the same kind of paper, and paste them on the others, one at a time; cut off with a knife what projects beyond the edges of the slate, and when the whole has become perfectly dry, wrap a small flat piece of slate in coarse sand-paper, and with this rubber make the surface of the paper quite even and smooth. Then paste on an inside sheet, which must be quite free from spots or dirt of any kind; cut off the pro-

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jecting edges as before, and when dry, rub it with fine glass-paper, which will produce a perfectly smooth surface. Now take half a pint of the size (No. 1), melt it by a gentle heat, and then stir into it three table-spoonfuls of fine plaster of Paris; when the mixture is completed, pour it out on the paper, and with a soft wet spunge distribute it as evenly over the surface as possible. Then allow the surface to dry slowly, and rub it again with fine glass-paper. Lastly, take a few spoonfuls of the size (No. 1), and mix it with three-fourths its quantity of water; unite the two by a gentle heat, and when the mass has cooled, so as to be in a semi-gelatinous state, pour about one-third of it on the surface of the paper, and spread it evenly with the sponge; when this has dried, pour on another portion, and afterwards the remainder: when the whole has again become dry, rub it over lightly with fine glass-paper, and the process is completed; it may, accordingly, be cut away from the slab of slate, and is ready for use.

The quantity of ingredients above mentioned is sufficient for a piece of paper 17 and a half inches by 15 and a half.

Paris plaster gives a perfectly white surface; oxide of zinc, mixed with Paris plaster, in the proportion of four parts of the former to three of the latter, gives a tint very nearly resembling ivory; precipitated carbonate of Barytes gives a tint intermediate between the two.

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N° IV.

TRACING INSTRUMENT.

TEN GUINEAS *were this Session presented to Mr.* D. NAPIER, *of Lloyd's Court, Soho, for a* TRACING INSTRUMENT. *One of the Instruments is preserved in the Society's Repository, and the following communication was received from him on the subject.*

Lloyd's Court, Soho,
Jan. 12, 1819.

SIR;

I BEG leave to request that you will have the goodness to submit to the consideration of the Society for the Encouragement of Arts, Manufactures, and Commerce, an instrument which I have lately invented, and have been at great pains to bring to perfection. The object of the invention is, to afford a more accurate method of copying outlines of any kind, such as drawings, maps, &c. either right, or reversed on copper for the engraver.

I am aware that this may be done with more or less correctness by the pantograph, but, in point of fact, I believe that engravers are not at all in the habit of making use of that instrument, partly on account of the want of precision in its execution, and partly because the slightest carelessness or inattention in drawing up the tracer is sure to produce false lines, and thus occasion much trouble in

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the etching. From these objections the present instrument will, I trust, be found to be free, and not to be unworthy of the attention of the Society.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. D. NAPIER.

Description of Mr. NAPIER'S *universal Tracing Instrument, Plate* V.

Fig. 1 is a plan of the instrument as adjusted to make a copy one-third smaller than the original. On the board A, of the frame B C D E is placed the original, and on the board F of the same frame is placed the paper, copper, or other material on which the copy is to be drawn.

Fig. 2 is a lateral view of the instrument, as adjusted to make a copy in reverse; in this case, the paper or copper is fixed to the underside of the board G, in the jointed frame H I K L, by the sliding springs M M. In proceeding to make a copy, the paper, &c. being fixed as above described, the tracer N O P Q R S, with its universal spring joint T U V W is made fast to the cross bar X, by the screw and nut Y Z; the graduated arms N O P Q of the tracer are made to pass through the sliding joints *a a*, as represented in figs. 6 and 7, for the purpose of making the copy of the same size as the original, or smaller. Having placed the sliding joints in their required situation, they are preserved in it by the small screws *b b* with pivot points, which are received in either of the small holes in the graduated arms over which the joints are placed. The tracer, which is a pencil or steel point, is introduced into the tube in the center of the joint C, with its point inverted. In the joint *d* at the other end of the instrument is a cylindrical pin *e*, with a blunt

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point (fig. 2), which is pressed down by the spring *f*, in the arm R; the point of the pin *e*, being in contact with the original drawing, the arms R S, will be raised by the action of the spring *f*, and, consequently, the arms P Q, will descend, pressing the tracer against the paper or copper. If the joint *d*, is pressed down by the universal jointed handle *g*, the pencil or steel point will be raised, which is necessary in passing from one part of the drawing to the other; for this reason, care must be taken in adjusting the instrument, that the pencil or steel point is free when the tube *d*, is pressed down to the part which prevents it from going too far, as represented in fig. 5. The handle *g*, is to be held in the hand, and moved with the fingers in the same manner as a common pen, taking care that the point of the pin *e*, moves steadily along the lines of the drawing, observing, when the point is returning, to take another line, that the tube *d*, be pressed down to the pin *h*, and that it be allowed to rise when the point has been placed on the beginning of the next line to be traced. The best method of tracing straight lines is to move the point along the edge of a ruler placed on the line of the drawing. Lines thus traced, whether strait or curved, are transferred by the pencil or steel point in the joint *c*, and bear the same proportion to the original that the graduated arms of the instrument do to the plain ones, the centers of the joints being the extremities of the arms.

In making a reverse tracing, the handle is used in the same manner, only the tube *d*, must be pressed down to the pin *h*, during the tracing, and must be permitted to rise when moving to take a fresh line. The jointed frame H I K L, is adjusted by the regulating screws and nuts *i i* (fig. 2), so that the pencil or steel point may press freely, without touching, until the tube *d*, is pressed down to the pin *h*. The jointed frame may at any time be raised up

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to examine the progress of the work, and may be replaced with the greatest accuracy.

Fig. 3 is a plan, and fig. 4 is a section of the universal spring joint; the use of which is, to allow the tracer to act either when raised or depressed without stiffness in its joints, and to remain level with the boards, when permitted to stand. Figs. 9, 10, 11, 12, 13, represent different views of its several parts; fig. 9 being two views of the upper part of the joint to which the tracer is connected by the screw *k*; fig. 10 being two views of a spring which is made fast to the under side of fig. 9 at *o*, by the screw *p*, at right angles to *l m*. Figs 11 and 12 represent the middle part of the joint, which is connected to fig. 9 by the center screws T W, passing through *l m*, and introduced into the female centers *q r*, with the points of the spring *n*, resting upon *s t*. Fig. 13 represents two views of the bottom part of the joint which is connected to fig. 12 at *s t*, by the screws U V, passing through *u v*, in the same manner as fig. 9, and having a spring similar to fig. 10, made fast at *w*, by the screw Y, in fig. 14; this screw connects the joint to the cross bar X, standing at right angles to *u v*, and having its points pressing upon *s t*.

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N° V.

IMPROVED VIOLONCELLO.

The GOLD ISIS MEDAL *was this Session presented to Mr.* J. BARRAUD, *of Charles Street, Westminster, for an* IMPROVED VIOLONCELLO. *A Model of the Instrument is preserved in the Society's Repository, and the following communications were received from him on the subject.*

23, Charles Street, Westminster,
April 19, 1819.

SIR;

IF it should appear to you that these lines relate to an object sufficiently interesting to be brought under the notice of the Society for the Encouragement of Arts, &c. I shall think myself particularly fortunate in arriving at so eligible and so honourable a medium through which I might be permitted to communicate to the musical world at large, the result of my attempts at a contrivance on which I have bestowed my leisure moments for some years past; and which, from the flattering testimonies I have recently received from some of the most competent judges of musical effect, I am induced to believe I have now brought to such a point, as fairly to accomplish the object I had in view; which was, to contrive an intermediate instrument between the violoncello, and the double bass, for the purpose of producing a more agreeable general effect in performance of chamber music than can be derived from the use of two violoncellos, or even of a

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violoncello and a double bass, when the modern arrangements of symphonies, and overtures in six or seven parts are to be performed in small, or even moderately-sized, but not lofty rooms.

It will, no doubt, by many be thought a very daring undertaking, on the part of a mere amateur, thus to presume to find fault with the established order of things, and to attempt an innovation where, it may be said, none has been deemed necessary hitherto. It should, however, be borne in mind, that accident has occasionally given birth to a first thought, which, being ruminated upon, modified and matured, has at last terminated in the production of an object really useful, and worthy of general adoption.

Whoever has listened attentively to the effect of arranged symphonies and overtures in seven parts, when performed with a first and second violoncello to the bass parts, must have perceived a certain meagreness of effect, arising from the absence of the grave tones required to give the due fulness and richness to such performances; and when a double bass is used with a violoncello in small, or even moderately-sized, but low rooms, the immense power of the former instrument (so essentially useful and grandly effective in the orchestras of public concert rooms and theatres) has the bad effect of constantly inducing such an over-exertion on the part of the performers on the other instruments (even when the double bass is discreetly managed, which is not always the case) as is completely destructive of true musical effect, which, in chamber music, must essentially depend on great delicacy of performance, and on the just and relative proportions of power between the several instruments forming the harmonious combinations in all the various gradations of sound, from a mere whisper of *pianissimo*, to the loudest pitch of *fortissimo*. And here, I trust, I may be permitted

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to observe, for the benefit of the young, and of the habitually inattentive amateur, that in chamber music, especially when performed in small rooms, the instruments should never be forced to the same degree of loudness they will admit of, without bad effect, in large and lofty rooms, because the expanse, in this case, softens down the natural asperities of the instruments, and diminishes the perception of that roughness and harshness of sound, which require to be subdued by the unceasing care and attention of the performer in small rooms, where the instruments may be said to be placed under the very ears of the auditory.

It is owing to the unpleasant sensations I have experienced from an injudicious use of the double bass in a small room, that I have been led to attempt an improvement of effect in the performance of the many delightful compositions and arrangements which have been intended chiefly, if not exclusively, for chamber music. My first idea was, to string a violoncello entirely with covered strings, so proportioned as to admit of tuning them a precise octave below the usual pitch of the violoncello; and in this state the instrument, when used for the second violoncello part in septetts, was found to produce an effect superior to that arising from the use of two violoncellos in unison; for although the instrument was greatly limited in power or loudness by the gravity of the tones thus obtained from it, it was still sufficiently distinct to blend with, and materially to improve the general effect.

Having, while in pursuit of this idea, been called upon to join in the performance of the music of some of Mozart's operas in private parties, I felt that by giving greater extension to my attempt, I might eventually succeed in producing an instrument which might prove to be of great utility; and I then formed my present enlarged plan of a

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double or octave violoncello, for the effective support of five or six voices, with the accompaniment of seven or eight instruments.

The instrument which I now offer to the judgment of the Society partakes essentially of the quality of tone peculiar to the violoncello, and unites, with the distinct and smooth articulation of this instrument, a greater range of grave tones than are produced from the double bass. It will not be expected that an instrument possessing little more than one-third of the capacity of the double bass,* and yet yielding five graver tones than the latter, should have to boast of great *loudness;* this diminution of power is precisely what I aim at, as my object is, to limit the instrument in such a manner as that it may blend with and enrich the effect of the others with which it may be combined, without the possibility of doing the mischief which I have complained of as inevitably arising from the use of the double bass in small rooms, that of inducing a constant over-exertion on the part of the other performers, which is completely destructive of all the finer gradations of sound, which consequently deprives the leader of an essential portion of his powers of expression, and makes music, at last, degenerate into mere noise, through which the ear attempts in vain to analyze the harmony. It is almost superfluous to observe that, in all things, the possession of very great power leads, generally, to very great abuse of it, and that as sound is increased by the size or improper management of an instrument, so will be the corresponding roughness or harshness; and this it is which ought to render the

* The capacity of the double bass is generally about five times that of the violoncello, and its lowest note (being chiefly used with three strings only in this country) is double A, which is two tones only lower than the violoncello C, on the fourth string open.

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means of proportioning the instruments in size, in number, and in the judicious and delicate management of them, so desirable and so essential an object, to be attended to by every amateur who wishes to give music with its due effect* in moderately-sized rooms.

My object has been to avoid that excess of power which I conceive to be detrimental to musical effect in small parties. I trust it will be found that I have not fallen into the other extreme. The instrument I have produced is capable of being rendered something more powerful than it is, as I use it myself by choice, and that without throwing any material difficulty in the way of the performer. My aim has been all along to preserve the usual length of the violoncello stop, so that any gentleman who is competent to perform on a violoncello in concert, may, with facility, perform on my instrument the second violoncello part in the arranged symphonies and overtures I have spoken of, and thus produce the effect of a well-proportioned double bass, with little more exertion than is required to play the same part on the ordinary violoncello. Thus it will be seen that the reading and the fingering remain just the same; the difference in the effect results from the size of the instrument being a little increased, principally in breadth and depth, from the strings being larger, to admit of tuning an effective octave below the pitch of the violoncello, and from the bow being a little heavier in proportion.

* If I were called upon to define what I mean by due effect, I should say that I conceive that true musical effect can alone proceed from the attainment of such complete subordination in the parts forming the accompaniments as should leave the melody, whether vocal, or proceeding from one or other of the instruments, duly prominent above the rest, in all the various gradations of sound; never forcing the melody above the line assigned to it by the composer, more particularly in the extremely piano passages.

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In the performance of pieces of ancient music, in seven parts, this instrument will be found to produce an effect peculiarly gratifying, and particularly so in the trios of Corelli and succeeding composers, either in combination with two violins and a violoncello as the additional organ or violone part; with a violin and a violoncello taking the second part; or, as they are sometimes played with increased effect, with two violoncellos in place of a first and second violin. I may say, with perfect confidence, that I am warranted by the highest and most respectable musical authority in this country to assert, that the effect of such combination stands unrivalled for due proportion of power, distinctness, and smoothness of articulation.

From what has been stated, and particularly after a fair trial of the instrument, it will, perhaps, be readily conceded that the double violoncello, from its limited extent of power, its completed scale of grave tones, and its manageableness, is the only perfectly adequate stringed instrument in existence as a proper and effective accompaniment to a violoncello in the performance of Corelli's violin solos, and pieces of a similar description, not excluding some of the more modern easy duetts, written for the violin and violoncello, often played with two violoncellos. In these points of view it must naturally tend to enlarge the sphere of enjoyment of violoncello players in particular, and of amateurs in general when used in more extended combinations.

I now subjoin a description of the instrument, such as I have no doubt will enable any intelligent manufacturer to produce an instrument similar, or perhaps superior, to that which I have had the honour to exhibit to the Society.

Height of the body of the instrument (plate VI, figs. 1, 2) .... 31 inches.
Extreme breadth of the upper bout ..... 18 do.

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Extreme breadth of the middle bout	13 inches
Do. of the lower do.	22 do.
Depth of the sides	$6\frac{1}{2}$ do.
The length of the stop to be preserved the same as for the ordinary violoncello, or from $26\frac{1}{2}$ to 27 inches.	
The breadth of the finger-board at the nut ...	$1\frac{1}{8}$ do.
At the extremity near the bridge	$2\frac{7}{8}$ do.

The first and second string to be placed at the same distance as for the violoncello; the third and fourth string to be laid wider for greater freedom in vibration. The bridge to be sufficiently curved to let all the strings lie fair for the pressure of the bow individually. The bridge to be wider, but not much thicker than for the ordinary violoncello; the width of the feet must depend on the situation given to the bar, which in my instrument I have had laid as near the sound-holes as possible. The sound-holes should be rather longer, and more open than for the ordinary violoncello. The button to fasten the tail piece should be sufficiently large to admit of receiving a screw of box-wood, or a plug to raise the instrument to the convenient height for playing, resting on the floor.

The first and second strings (figs. 6, 7) should be a violoncello third and fourth of the largest size.

The gut for the third string *e* (fig. 5) should be in diameter equal to the *covered string* used for the second, and the gut should be covered with a silvered wire *f*, about thethickness of a small sized first string for a tenor. The gut for the fourth string *a* (fig. 4) to be in diameter equal to the *covered third*, and to be lapped with silvered wire of three different thicknesses *b c d*, each succeeding one filling up the interstices of the former. These large wires should be laid on with great care, to keep them in close contact, particularly at that part which is to be acted upon with

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the bow, to prevent the hair of the bow from being caught.

The third and fourth strings require to have a greater weight used for the covering, in order to make the wire lie perfectly close and to guard against rattling; I have preferred for my own use to have pegs for the first and second string, the same as for the usual violoncello, the tension of the strings being but little increased. For the third and fourth string screws similar to those of the double bass are necessary, only of smaller dimensions. Each string to be tuned an octave below the open A, D, C and G, of the violoncello. The bow (fig. 3) to be something heavier than those in general use for the violoncello, according to the previous habit of the performer.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.

J. Barraud.

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PAPER

IN

MANUFACTURES.

N° I.

FRAME FOR DRYING WOOLLEN WARPS.

The SILVER ISIS MEDAL *of the Society, and* TEN GUINEAS, *were presented this Session to Mr.* GEORGE RHODES, *of Saddleworth, near Manchester, for his improved* FRAME FOR DRYING WOOLLEN WARPS.—*The following communications have been received on the subject, and a Model of the Machine is placed in the Society's Repository.*

Lydgate,
Sept. 5, 1818.

SIR;

MR. GEORGE RHODES of Wadehill, in Saddleworth, in the West Riding of the county of York, about five years ago invented a *drying frame* for woollen warps upon a different plan from any hitherto in use, and which, from experience, can be proved, by indisputable evidence, to be of the greatest utility.

It is upon a superior principle to any thing of the kind

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ever known to the woollen weavers in this part of the nation, and from its peculiar, though simple construction, will prepare a warp for the loom in the winter season (the time when the weavers labour under the greatest inconvenience), in about *three hours*, on an average, according to the nature of the colour, whilst the old frame requires from *fifteen to twenty hours*.

This frame may be so constructed as to hold more warps than one, according to the largeness of the room. The warp is folded upon the frame in a cylindrical or square form, and each warp or fold separated from the other by slides let into the arms of the frame by grooves.

By the rotatory motion given to the frame, which may be turned by the hand or otherwise, the moisture is thereby thrown from the center to the outside, and the heat of the fire or stove has a gradual and equal effect upon the whole warp.

I am, Sir,
&c. &c. &c.
B. Cleasby.
Minister of Lydgate.

A. Aikin, Esq.
Secretary, &c. &c.

CERTIFICATE.

Saddleworth,
Nov. 11, 1818.

We, whose names are hereunto subscribed, beg leave to recommend to the notice of the Society for promoting the Arts, Manufactures, and Commerce, a piece of machinery invented by Mr. George Rhodes, of Wadehill, in Saddleworth, near Manchester, for the purpose of drying woollen warps; being well convinced, by experience, of its great superiority over any thing of the kind ever used in

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this country by the woollen weaver. The old frame used before this was invented, required from *fifteen to twenty hours* to dry a warp, on account of its standing upon four pillars, and was so large that it could not be moved before a fire or stove. This new one is so contrived as to have the warp stretched upon rods of wood of about one inch square, which are let into grooves in two arms crossed at each end of an axle, and turned by the hand before a fire or stove.

By turning the machine or frame before a fire or stove, all the parts receive a gradual heat, and thus the warp will be dried in two or three hours, according to the colour of the warp.

Having thus stated the facts which we know from experience, both as touching its great superiority over others, and Mr. Geo. Rhodes being the inventor of it, we beg leave to recommend him to the notice of the Society, entreating for him such reward as the Society may be pleased to confer upon him.

We are,

&c. &c. &c.

JOHN SCHOFIELD.
WILLIAM WILSON.
JAMES PONTEFRACT.

References to the Engravings, Plate VII.

Fig. 6, an oblique view, and fig. 9, a transverse section of the instrument.

a a, the axis.

b, the handle.

c c c c, the arms, fixed into the axis.

d d d, the cross bars, of which two are shown detached,

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fig. 8. These bars slide in grooves cut in the arms, as shown fig. 7.

The method of putting on the warp is quite simple. Begin with all the cross bars out, except one of those nearest to the axis; lay the end of the warp over the bar; then, holding the warp in one hand, turn the winch with the other, dropping in a cross bar at every quarter revolution of the axis, till the whole of the warp has been laid on.

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PAPERS

IN

MECHANICS.

N° I.

NAVAL CARTOUCH-BOX.

The SILVER ISIS MEDAL *of the Society was given this Session to Capt.* T. M. BAGNOLD, *R. M. of Knightsbridge, for his improved Method of fixing the* NAVAL CARTOUCH-BOX.—*The following communication has been received from him on the subject, and one of the Cartouch-Boxes is placed in the Repository of the Society.*

7, High Row, Knightsbridge,
March 30, 1819.

SIR;

I TAKE the liberty of submitting to the Society for promoting Arts, Manufactures, and Commerce, a new mode of fixing the naval cartouch-box, by which the disappointment so frequently experienced by its inversion, and loss of ammunition is prevented. It has met the approbation of Lord Exmouth, and of several eminent naval officers, whose testimonials in its favour I shall be happy to lay before the Committee.

I am, Sir,

&c. &c. &c.

T. M. BAGNOLD.

A. Aikin, Esq.
Secretary, &c. &c.

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CERTIFICATES.

HAVING inspected the alteration proposed by captain Bagnold, R. M. on the naval cartouch-box, we consider it a very useful improvement, inasmuch as it will prevent the frequent loss of ammunition, occasioned by the upsetting of the box, so common with the present pattern; and we consider the box marked 1, as the best adapted for the purpose.

J. PEARCE.
CHAS. SHAW.
THOS. DUNDAS.
STEPHEN POPHAM — *Capts. of the Royal Navy.*

HAVING inspected the improvement proposed by capt. Bagnold, R. M. on the cartouch-box at present in use for seamen on board his majesty's ships of war, we consider that marked N° 1, to be most likely to prevent the box from upsetting when buckled round the waist.

R. DOYLE.
J. F. MAPLES.
AMB. CROFTON.
G. G. PENNOCK.
W. BATHURST.
W. STUART.
H. E. REGINALD BAKER.
J. M. HANCHETT — *Capts. of the Royal Navy.*

18, Bolton-street,
April 3, 1819.

SIR;

THE improvement you have suggested for strapping and better securing the seaman's cartouch-box when he is employed on any detached service, appears to me so

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extremely beneficial, that I very sincerely hope you will give us a chance of its general adoption in the navy, by submitting your improved plan to the inspection of the Admiralty.

I am, Sir,
&c. &c. &c.

Capt. Bagnold, R. M. MURRAY MAXWELL.

SIR; Dock-yard, Plymouth.

HAVING inspected capt. Bagnold's proposed alteration in the naval cartouch-box, I am of opinion that it completely prevents the frequent inversion, and consequent loss of ammunition hitherto complained of, and is therefore a considerable improvement.

I am, Sir,
&c. &c. &c.
W. SHIELD,
Commissioner.

SIR; Admiralty Office, April 22, 1819.

MY Lords Commissioners of the Admiralty having had under their consideration your letter of this day's date, and its inclosure, together with the two cartouch-boxes which accompanied it, I have their lordships commands to acquaint you, that they have sent a copy of your said letter, together with the cartouch-boxes, to the Board of Ordnance, and expressed their opinion that the alteration you have suggested in the latter should be adopted.

I am, Sir,
&c. &c. &c.

Capt. Bagnold, &c. J. W. CROKER.

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The cartouch-box in use among sailors is of a curved form, and is fastened in front of the body by a strap that passes through two loops fixed on the anterior part of the box. The consequence of which is, that in the hurry and eagerness by which the assaults of sailors in boarding ships and storming batteries are generally characterized, the box gets turned bottom upwards, and the cartridges fall out; thus leaving the seaman no other resource than his cutlass, or using the musquet as a club. The possibility of this accident is prevented by the very simple and effectual contrivance of capt. Bagnold, who adds two metal loops to the back of the box, as represented in the plate.

Pl. VII, fig. 1, a vertical view of the box.

a a, the strap, passing through two front loops *b b*, forming the present method of fastening the box.

c c, the two additional loops proposed by capt. Bagnold.

d d, the proposed arrangement of the strap which passes first through loop *c*, then through both loops *b*, and then through the other *c*.

Fig. 2, a back view exhibiting the two additional loops *c c*.

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N° II.

ROWLOCK.

The SILVER MEDAL *of the Society was this Session presented to* WALLOP BRABAZON, *Esq. of Ireland, for a* ROWLOCK.—*The following communication has been received from him on the subject, and the Instrument is placed in the Society's Repository.*

40, Portland-place, London,
March 1, 1819.

SIR;

I REQUEST that you will lay before the Society of Arts, &c., the Rowlock which accompanies this communication. Its great superiority over the common methods of securing the oars of a boat from being unshipped, and the greater length of effectual stroke that can be made by it, will, I trust, recommend it to the favour of the Society. I have had repeated trials made with it on the Irish coast, both in pleasure-boats and in life-boats, and it has given me entire satisfaction.

This rowlock being fastened down, by means of a grommet, to a timber head, and a lashing being passed through the two upper eyes, it is impossible for the oar to rise off the gunwale of the boat. This gives the rower a very powerful purchase, by which he may at any time prevent the boat from upsetting, by laying the flat blade

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of his oar on the surface of the water, and prizing up the gunwale. Besides this, there is another great advantage in the more rapid progress of the boat. In the common rowlocks the oar must have considerable play, by which nearly a foot of the space through which the rower's body moves, when he leans back to pull, is lost, and makes no impression on the boat, as the oar takes that much of his exertion, merely to bring it home to the thowel next to him; and until it once touches that, it does not send the boat forward. But with this rowlock, which fits the oar, the moment the man *begins* to pull, *that moment* the boat *begins* to spring forward. Besides which, as the rowlock has nothing to check it in its turning, the rower may take the longest stroke with the oar that his strength and activity will enable him.

Even should the boat fill with water, the oars being fastened to the gunwale, their buoyancy is now added to the buoyancy of the materials of the boat; and if the oars are made of fir timber, which is the lightest and the most elastic, each oar will sustain a man in the boat until assistance arrives. Alongside a ship these rowlocks are very easily taken out and put in again. The oar that works in this rowlock must be round to enable the man to feather it. And it must be frapped with copper, or sheet iron, to preserve it from wearing in the working part. On the whole, with these rowlocks a boat will move *much* faster, and it will neither sink nor upset.

I am, Sir,
&c. &c. &c.
W. Brabazon.

A. Aikin, Esq.
Secretary, &c. &c.

References to the Engraving, Plate VII.

Fig. 3. *a* the rowlock, *b* the grommet, passing through an eye in the bottom of the rowlock.

Fig. 4. A view at right angles to the preceding: *d*, a

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section of the oar; *c*, a lashing of cord passed through the two eyes of the rowlock, in order to secure the oar in its place; *e*, a wooden bolt passing through a staple in one of the ribs of the boat, and keeping the rowlock in its place.

Fig. 5, section of part of the boat.

f, a socket let into one of the timber-heads for the reception of the stem of the rowlock.

g, the staple driven into one of the ribs of the boat.

N° III.

UNIVERSAL CHUCK.

The SILVER MEDAL *of the Society and* TEN GUINEAS *were this Session presented to Mr.* A. BELL, *of Bermondsey, London, for an* UNIVERSAL CHUCK *for the use of Turners.—The following communication has been received on the subject, and the Instrument is placed in the Society's Repository.*

Bermondsey, London,
Nov. 9, 1818.

SIR;

I HAVE taken the liberty of sending you an Universal Chuck of my invention, and request that you will present it to the Society for promoting the Arts, Manufactures, &c., for their inspection.

I am, Sir,
&c. &c. &c.
ALEX. BELL.

A. Aikin, Esq.
Secretary, &c. &c.

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The object of Mr. Bell is, to save the greater part of the time which is consumed in fitting to a chuck of the common figure all materials, such as wood, brass, ivory, &c. intended to be fashioned in the usual turning lathe. No substance can be truly turned, except its axis forms a continuation of the axis of the lathe, and except it is fixed so firmly in its chuck as not to give way to the pressure of the tool, and to any accidental jolts or shocks which it may experience. The contrivance by which these objects are effected in the present instance, will be fully understood from the subjoined engraving.

References to Mr. A. BELL'S *Chuck for Turners, Plate* VIII.

Fig. 1, a side view; fig. 2, a front view; and fig. 3, a section of the entire instrument.

Fig. 4, a front view, and fig. 5, a section, of the pieces A and B, detached from the rest.

Fig. 6, a section of the piece C (figs. 1, 2, 3).

Fig. 7, a section of the piece D (figs. 1 and 3).

a (figs. 3 and 5), a female screw, by which the chuck is fastened on the maundrel of the lathe.

b (figs. 2, 3, 4, 5), a stud projecting from the face of A, and which fits into the collar of the piece B.

c c (fig. 4), two screws by which the piece B is secured to the face of A.

d d d (figs. 4 and 5), pivots forming the centers of motion to as many arms, the screwed extremities of which, *e e e*, clip, and thus hold fast the piece of wood or metal, &c. intended to be turned.

f f f (figs. 2 and 6), slits in the face of piece C, along which the extremities of the arms traverse, and by means of which, they are made always to represent the boundaries of an equilateral triangle.

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g (fig. 6) an orifice in the center of the plate A, which receives the stud *b*.

h h (fig. 6) a screwed collar in piece C, in which the neck *i i*, of piece D (fig. 7) screws, and thus locks fast the arms *e e e*, which hold the substance to be turned.

k, a hole in the rim of piece C (fig. 1) for the purpose of receiving a lever by which the screw is tightened or loosened.

N° IV.

UNIVERSAL CHUCK.

The SILVER MEDAL *of the Society was this Session presented to Mr.* THOMAS HACK, *of Bankside, London, for an* UNIVERSAL CHUCK, *for the use of Turners.—The following communication was received from him on the subject, and the Instrument itself is placed in the Repository of the Society.*

Bear Garden Iron Works, Bankside,
February 10, 1819.

SIR;

I SEND herewith a tool which I have designed for the use of turners in general, which I believe, from my own experience, and the opinions of several scientific gentlemen who have seen it in use, to be an improvement upon all other tools used for a similar purpose.

I have denominated it a "Universal Lathe Clutch, or

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Chuck;" as it will not only hold any thing within its dimensions, but will, at the same time, and of self action, as it were, produce an accurate center; and as this I believe to be quite new in practice, I submit it to the consideration of the Society.

As I may have another opportunity of explaining (if explanation be at all necessary) its component parts, I shall not detain you longer than to subscribe myself,

Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOMAS HACK.

References to the Engraving, Plate IX.

Fig. 1, a side view, and fig. 2, a front view of the instrument.

Figs. 3, 4, 6, sections of the nut, the back plate, and the fore plate, being the three pieces of which the instrument is composed.

Fig. 5. a front view of piece 4.

a (fig. 6) a female screw, by which the chuck is fastened on the maundrel of the lathe.

b (figs. 1, 6) a left-handed male screw, on which the nut *c* (fig. 1) traverses: the section of the nut is shown fig. 3, and its use is to keep the other parts of the chuck firm, for which purpose it is screwed up to the back plate (fig. 4) by means of the wrench (fig. 8).

d, a round hole in the center of the back plate (figs. 4, 5) through which the screw of the front plate passes.

e e e e (fig. 5) four pivots forming the centers of motion to as many arms, the screwed extremities of which *f f f f*, (figs. 4, 5) receive the pieces *g g g g* (figs. 1, 2), which clip, and thus hold fast the piece of wood or metal intended to be turned; the faces of these pieces are roughened like files, that they may hold the firmer.

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h h (fig. 4) holes sunk in the back plate for the purpose of turning it by means of the wrench fig. 7, and thus causing the arms to grasp any object offered to them.

i i i i (figs. 2, 6) slits in the front plate, along which the arms traverse, and by means of which they are always equidistant from the center.

k (fig. 1) a hole to receive the wrench (fig 9) and thus to facilitate the tightening or loosening of the instrument.

N° V.

PLOUGH GAGE FOR CUTTING LEATHER.

The SILVER ISIS MEDAL *was this Session voted to Mr.* RICHARD GREEN, *for a* PLOUGH GAGE *for cutting Leather.—The following letter was received from him on the subject, and the Instrument itself is preserved in the Society's Repository.*

20, Lisle Street, Leicester Square,
December 14, 1818.

SIR;

I WILL thank you to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce, the instrument which accompanies this letter. It is a plough-gage, for the purpose of cutting leather of any thickness into straps and thongs for bridles and harness. The price of the instrument is moderate, not exceeding 25*s.*; and by means of it, leather may be cut both more expeditiously and correctly than the best workman can do by hand. Ten or twelve of the instruments are now

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in use among the trade, and the satisfaction which they give, induces me to submit the invention to the judgment of the Society.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. RICHARD GREEN.

In the year 1810 the Society rewarded Mr. Lewis Aubrey for two machines, by the combined action of which leather straps may be cut not only uniform in breadth, but of an equal thickness; the latter quality being particularly desirable in all bands employed in communicating motion to machinery. Mr. Green's instrument is intended merely to secure a perfect equality of *breadth* in the straps cut by it, and therefore is applicable chiefly to the purposes of collar and harness-makers. The expedition, however, with which the instrument works, its moderate price, and the correctness of its action, have induced the Society to confer on the inventor an honorary mark of approbation.

Description of the Instrument, Plate X.

Fig. 1 is a side view.

Fig. 2, a vertical view.

Fig. 3, a view at right angles to fig. 1.

Fig. 4, a vertical view opposite to fig. 2, the instrument being turned bottom upwards.

a, the handle.

b, the sole, made flat at the bottom (fig. 4), and having a side piece *c c*, rivetted on, projecting from the sole, so as to enable the instrument to traverse steadily and evenly along the edge of the cutting-board, as it lies on the table.

d, the knife, having the sharp edge on the convex side.

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It rests in two grooves, which are commanded by the screws *e f*, and therefore may instantly be taken out to be sharpened or replaced by a new one; and may likewise be set to any required elevation, in consequence of the bar to which the screw *e*, is attached, being moveable on the rivet at its other extremity.

g, a graduated bar, projecting from the sole at right angles, and having the under side hollowed out, forming a groove for the reception of the screw *o o*.

h, a roller, parallel to the graduated bar, and advanced a little in front of the edge of the knife; it turns freely on its axis *i*, which axis is terminated at one end by a short hollow screw: in this the solid screw *k* works, and thus raises or depresses the roller, as far as the slit *l* in the upright socket *m* (fig. 3), will permit.

n, a piece supporting the socket *m*, and therefore the roller *h*: it is perforated to admit the graduated bar *g*, and is moved to any required division of the bar, by means of the screw *o o* (figs. 3, 4).

In order to use the instrument, having determined on the width of the intended strap, turn the screw *o*, and thus move the piece *n*, till its inner edge correspond with the proper division on the graduated bar *g*. Then, by means of the screw *k*, adjust the roller till the space between it and the graduated bar is somewhat wider than the thickness of the leather: afterwards, place the instrument so that the piece *c c* (fig. 4) presses against the edge of the cutting board; lay the leather under the roller with its outer edge touching the piece *n*, and by a firm and continued stroke, urge the instrument forward: the knife, being properly adjusted by the two screws, will then cut off a strap, the breadth of which is equal to the distance between the knife and the piece *n*, as ascertained on the graduated bar.

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N° VI.

SPRING CLIP.

The SILVER ISIS MEDAL *and* FIVE GUINEAS *were this Session voted to Mr.* W. BULLOCK, *for his* SPRING CLIP *for Screens, &c.—The following communication was received from him on the subject, and a Model of the Invention is preserved in the Society's Repository.*

16, Queen Street, Soho
Jan. 25, 1819.

SIR;

I REQUEST that you will lay this letter and the accompanying model of a Spring-clip before the Society for the Encouragement of Arts, Manufactures, and Commerce.

The inconvenience which it proposes to remedy, may by some be esteemed trifling, although others, to whom the continuance of the original beauty of every article of ornamental furniture is of importance, may esteem more highly the object for which the instrument was at first intended.

Since it has become the fashion to gild or varnish highly the poles on which light and ornamental fire-screens are supported, it is obvious that the friction of the spring and rings by which the screen is commonly made to traverse up and down the pole, is productive of much mischief. The varnish and gilding are scraped off, thus rendering an elegant piece of furniture unsightly long before the other parts get so much soiled and worn as fairly to justify its being discarded.

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To prevent this occurrence is the object of my invention. The lower ring is considerably wider than the pole, being intended only to steady the screen, and therefore cannot without extreme carelessness do injury to the pole when traversing on it: the upper ring or clip, consisting of two levers acting against each other, is made firmly to embrace the pole by the action of a double spring; and, when the screen requires to be raised or lowered, nothing more is necessary than to press with the finger and thumb against the long ends of the levers till the clip is relaxed, when the change of position of the screen may be effected with the utmost ease, and without any injury to the varnish of the pole.

The same contrivance may be applied as a secure and expeditious way of changing the height of branches for lights, of the rings of chemical stands, &c.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. WM. BULLOCK.

Reference to the Figures of Mr. BULLOCK'*s Spring Clip, Plate* X.

Fig. 5, *a a*, a round staff or pole of wood or metal: *b*, a branch for a light, a fire-screen, &c.: *c*, the spring-clip, by means of which the branch *b* is retained at any required height on the pole *a a*.

Figs. 6, 7, 8, represent the several parts of *c* (fig. 5).

d d, holes for screws or rivets, by means of which the branch and spring-clip are fastened together.

e, a ring passing loosely over the pole *a a* (fig. 5).

f f, a double spring, suspended by the screw *g*.

h h (fig. 6) two levers, the common fulcrum of which is the screw *i*, which is secured in the square perforated piece *k* (fig. 7).

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The short arms of these levers terminate in semicircular jaws, forming the clip; while the long arms, being acted on by the spring *f f*, keep the jaws constantly closed, except when it is counteracted by pressing inwards with the finger and thumb against the ends *l l*.

Fig. 9 is a back view of the levers, showing their external edges *m m*, to be raised and turned back a little, in order to retain the spring in its place.

N° VII.

IMPROVED METHOD OF LOCKING THE COCKS OF LIQUOR CASKS.

The SILVER MEDAL *of the Society was this Session presented to Mr.* W. RUSSELL, *of Chelsea, for an* IMPROVED METHOD OF LOCKING THE COCKS OF LIQUOR CASKS.—*The following communication has been received on the subject, and Drawings of the Invention are placed in the Society's Repository.*

Avery Farm Row,
Chelsea.

SIR;

I BEG leave to submit for the consideration of the Society for the Encouragement of Arts, Manufactures, and Commerce, a new, simple, and effectual method of locking liquor cocks, particularly those of the common kind.

There are but two ways at present practised of locking common cocks; the first is universally used and known,

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and a specimen of it accompanies this communication. It has a perforated cap, soft soldered to the barrel of the cock immediately over the ground plug, the top of which plug is formed to the shape of the perforation, and a socket key of the same form is introduced to turn the plug, i. e. to open the cock. The insecurity of this method of locking is evident; for instance, take an impression of the perforated cap with the thumb, or in many other obvious ways, and for about sixpence a fac simile of the original key may be purchased at any ironmonger's shop in London.

But, in fact, it is unnecessary to resort to impressions, or the purchasing a key; for a pair of compasses, or a strong common table fork applied at the rivetted end of the plug, will generally open the cock, without having access to the key-hole. Again, lock cocks upon this principle can only be used for domestic purposes; for to make them of a large bore, would so much increase the friction, as to require a ponderous key to open them.

Another objection to this lock cock, which in reality has no lock at all, is, that the cock cannot be repaired or fresh ground, without first unsoldering the perforated cap, which is extremely inconvenient, and the heat necessary to resolder it, is frequently injurious, by destroying the lubricating quality of the grease, which surrounds the ground plug. The second method in practice for locking large cocks is, by an iron saddle or staple passing over the plug and below the bottom of the cock, through which a bolt is put, and a pendent padlock attached; it appears, and is admitted, that this method is in the first instance expensive, and at all times inconvenient, by having the whole to remove before the cock can be opened, but still it has a decided preference over the former, because cocks of the largest bore are effectually locked by this means, and may be repaired

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without heating. The cocks of large coppers, stills, distillers vats, &c. &c. are locked in this way.

Having briefly stated what I conceive objectionable in the present mode of locking liquor cocks, I will proceed to explain my new or improved method. In plate XI, fig. 1, is the section of a common liquor cock, with the improved lock attached to the front of the barrel. The drawing represents the cock shut and locked, and the method I have adopted is simply this: the cock being shut, a hole about three-sixteenths of an inch in diameter is drilled through the barrel and into the plug *a*, this hole is filed square, and a moveable steady pin or bolt *b*, with a shoulder to limit its action, is fitted, passing through the barrel and into the plug; the opposite end terminates in a screw, over which is a spiral spring resting on the shoulder; a turned brass socket *c*, having also a shoulder about midway to press upon the spiral spring, is then put over all, and secured to the barrel either by solder or screws; if by the latter only, the notches in the heads must be filed out, for obvious reasons; the one accompanying this communication is both screwed and soldered on. To open the cock, or rather to withdraw the bolt, the screwed socket-key *d*, must be introduced; when about two turns will sufficiently compress the spring and withdraw the bolt, and the cock may then be opened and shut at discretion, so long as the screwed key remains in this position. When the key is withdrawn, it locks itself (by the action of the spring on the bolt) upon shutting the cock. The size of the bolt may be increased in proportion to the size of the cock.

Mr. Bramah's patent lock being admirably calculated to give effect to this mode of locking liquor cocks, and also for producing that perfect security which no other lock possesses, I have attached a small box of guards to the improved cock bolt, and affixed it to the side of the

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barrel, as shown in perspective at fig. 2; and at the front of the barrel, as represented at fig. 3. It may be necessary to observe that this lock, as well as that in fig. 1, may be attached to the lower as well as to the upper part of the barrel, with precisely the same effect. The application at the front of the barrel has the preference only from being more uniform.

In order to show the superiority of the application of this valuable lock, I have, in plate XII, endeavoured to exemplify its principle as applied to my improved method of locking liquor casks.

Fig. 1 is a transverse section (full size) of the cock and lock, showing the box of guards attached to the SIDE of the cock. The figure represents the cock *shut* and *locked*, the bolt appearing quite through the barrel and passing into the plug *e*: *a a* the cap covering and securing the revolving barrel. The application is as follows: in the center of the revolving barrel I have fixed a double thread screw *b* (a single or triple thread may occasionally be used). This screw revolves in the movable bolt *c c*, which is square on the outside, having a shoulder to limit its motion, and moves it *into* and *out* of the square mortice made in the plug to receive it. To unlock the cock, the key *d* is introduced, and in one revolution or turn, withdraws the bolt *c* from the plug *e*. The cock may now be opened and shut at discretion, so long as the bolt remains free from the plug. To lock it, the key is turned one revolution the reverse way, precisely in the way of locking and unlocking common locks. Fig. 2 is also a section representing the cock unlocked, i. e. the bolt withdrawn from the movable plug entirely into the barrel of the lock.

The superior security of this method of locking liquor cocks is, I presume, apparent, from the *cock bolt* being inaccessible and immovable, unless the internal works of the lock are destroyed, for it cannot be picked.

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Fig. 3 is a view of the revolving barrel and bolt complete, detached from the cock; *c* the bolt.

Fig. 4 is an end view of the barrel and bolt; *c* the bolt.

Fig. 5 is the front end view of the barrel and sliders.

Fig. 6 is a section of the barrel.

Fig. 7 is an end view of the barrel divested of the sliders.

Fig. 8 is a section of the cap.

Fig. 9 is an end view of the cap, showing the key-hole.

Figs. 10, 11, 12, 13 and 14, represent the sliders and their locking plate detached.

Fig. 15 is a view of the double thread screw *b* which moves the bolt into and out of the plug *e*, as represented in fig. 1: the spiral spring *f* and socket *g* replace the sliders when the key is withdrawn.

Fig. 16 is a section of the hoop which secures the locking plate in its place; it is secured to the cap by two screws, as shown at *h h* in fig. 1.

Fig. 17 is an end view of the same, showing the projections which are notched into the locking plate.

Fig. 18 shows the locking plate as fixed to the cap, with the sliders removed from the notches.

Fig. 19 shows the locking plate as fixed to the cap, with the sliders in the notches as when the cock is locked.

Fig. 20 represents the key and locking plate laid open; the sliders are here shown pressed down by the key, and the notches in the sliders, which are at unequal distances, now correspond with the notches in the locking plate, so that the locking plate may be drawn backwards and forwards.

Fig. 21 represents the same, but the key is withdrawn, and the notches in the sliders being removed from the notches in the locking plate, this cannot be drawn backward and forward as in fig. 20. This is intended to elucidate the principle.

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It may be worthy of remark, that, although the cock in plate XI, fig. 1, is not to be compared with figs. 2 and 3, in point of mechanism, it has, from its cheapness, simplicity, security, and durability, advantages, when contrasted with the *common lock cock*, which may not appear to a superficial observer. For instance,

It cannot be opened from an impression taken of the key-hole.

An impression of the secured bolt must be obtained in order to make *tools* to make a key.

The extreme difficulty of getting this impression renders it next to impossible; for,

It must be first ascertained whether the screw bolt has a single, double, or triple thread, and whether the thread is fine or coarse.

It cannot be opened by any instrument applied to the rivetted end of the plug.

The plug may be taken out and the cock repaired (fresh ground) without unsoldering any part.

By varying the *diameter* of the screwed bolt, and also the form of the thread, an infinite variety may be obtained.

All liquor cocks NOW IN USE, from the smallest wine cask to the largest still or vatt cock, may receive this security at a small expense.*

The key to unlock the largest cock ever made may be carried at the watch chain.

The above specified method of locking is applicable to other purposes, such as window or shutter fastenings, and some doors; but my chief object has been to lay before

* Many gentlemen have already availed themselves of this improvement; among whom are Messrs. Deady and Henley, of Tottenham-court Road; Messrs. Stracey and Co., Smithfield Bars; Mr. Davis, Old-Street, Distillers, &c. &c. &c.

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the Society, a cheap, simple, and secure method of locking liquor cocks only.

I flatter myself these observations, with the accompanying specimens, will sufficiently show the superiority of this contrivance; and hope they may in some degree merit the approbation of the Society, and also that the public may derive some advantage by adopting the improvement I have made upon this useful article,

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WILLIAM RUSSELL.

N° VIII.

BOW AND STRING RAFTER.

The SILVER MEDAL *of the Society was this Session voted to Mr.* GEO. SMART, *of Lambeth, for a* BOW AND STRING RAFTER.—*The following communication has been received from him on the subject, and a Model of the Invention is placed in the Society's Repository.*

Ordnance Wharf, Westminster-bridge,
April 24, 1819.

SIR;

HAVING long been convinced of the great utility of flat roofs, especially in London and other great towns, where space is very valuable, I have for some time turned my attention to the discovery of the most economical and effectual method of constructing them. After various experiments, I at length ventured to put my plans in execution on a large scale, at the premises whence this letter is

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dated; and the highly satisfactory result of this trial induces me to communicate some particulars of it to the Society of Arts, &c. It will give me great pleasure to be honoured with a visit from the Committee at this place, where a simple inspection of the building will be more satisfactory than the most elaborate description. Some general idea, however, of the method which I have followed may be derived from the following particulars: Over the rafters I nailed down very strong laths, with moderate intervals between each, and laid upon them a platform of bricks bedded in cement: the bricks are covered by a layer of foot tiles laid in cement, having the joints pointed with mastich cement, and their upper surfaces twice coated with linseed oil laid on boiling hot. The roof, although on a superficial view it appears flat, has yet sufficient declination towards the sides to allow the free escape of water; and from an experience of several months I have reason to be entirely satisfied with its soundness. Its cost is not more than half the price of lead, and the only objection that can be urged against it is its weight. To counteract this, I have made an alteration in the form of my rafters, which I find to be effectual; and a description of which I here subjoin, as well as a model.

I take a square spar of the usual size for a rafter, and, by means of the circular saw, make an incision in it as represented at *b b* (fig. 1, pl. XIII); I then make the cut *c*, at right angles to the former and equidistant from the two ends; lastly, I make the two cuts *d d*, taking out a thin wedge from each place. The two pieces *c d* are then to be gently raised up till they form an angle of 10° or 12° with the piece *b b*; and are secured in their place by the insertion of a key-wedge *e* of seasoned oak, as represented fig. 2. It is obvious that a weight pressing on the key-wedge of this rafter (the ends being properly supported),

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will be sustained till either the fibres of the wood forming the string are drawn asunder, or till the lateral cohesion of the wood forming the butt ends of the rafter is destroyed; at the same time, there is no lateral pressure on the wall, or other support.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEO. SMART.

N° IX.

DOUBLE DOOR SPRING.

The SILVER ISIS MEDAL *of the Society and* TEN GUINEAS *were this Session given to Mr.* JAMES WHITE, *of Laystall Street, for a* DOUBLE DOOR SPRING.—*The following communication has been received from him on the subject, and a Model of the Invention has been placed in the Society's Repository.*

38, Laystall-street, Liquorpond-street,
March 14, 1819.

SIR;

I BEG leave, through you, to present to the Society for the Encouragement of Arts, Manufactures, and Commerce, an improved double door spring of my invention. Its construction is very simple, as will be evident on inspection.

The axis of the door passes down beneath the floor into an iron box, and has two friction rollers laterally attached

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to it. These rollers bear on the extremities of two levers, the other ends of which are in contact with a spring of the form of a bow. The center of this spring lies between two upright pieces, by which it is kept in its place, while the two ends of the spring are each in contact with a lever. When the door is opened inwards, one of the rollers acts on its lever, which, in its turn, strains the end of the spring with which it is in contact; and when the door is let go, the resistance of the spring again brings the door to its former position. The same happens if the door is opened outwards, except that the other lever and roller are brought into action. Besides the simplicity of this construction, a farther advantage is, that the strength of the spring is the greatest precisely where it is most wanted, namely, to keep the door closely shut. The cost of a full-sized spring of this kind will probably not exceed twenty-five shillings.

I am, Sir,

A. Aikin, Esq. &c. &c. &c,

Secretary, &c. &c. JAMES WHITE.

References to the Engravings, Plate XIII.

Fig. 3. The dotted lines *f f* show part of the door shut; *g* the center on which the door turns; the dotted circle *h h* is a plate fixed on the center *g*, and carries two centers *i i* for the rollers *k k* (as shown in a side view fig. 5, and in section fig. 6).

l m are two tumblers pressed equally on the rollers *k k* by the spring *n n*.

o o are two stops, to prevent the tumblers from acting farther than to shut the door.

p is a screw to regulate the power of the spring *n n*; by turning the nut *q*, the screw is advanced to, or withdrawn from, the spring.

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Fig. 4 shows the position of the rollers and tumblers when the door is opened at right angles. The tumbler *m* remains at rest against the stop *o*, while the tumbler *l* is pushed back against the stop *r* and the roller, nearly in a line between its pressure and the center of the door *g*, by which the tendency of its action to shut the door is diminished; and, as it would be lost if the roller came quite between the center and the pressure, the stop *r* is put to prevent it from coming so far. On opening the door the other way, the tumblers alternately change their positions; the end of the spring *n* also approaches nearer the center of that tumbler which is in action, and thus lessens its power on the tumbler.

Fig. 5. *s s* an angle fixed on the center *g* by means of a nut or socket, and screwed to the bottom corner of the door (shown in section fig. 7); so that by merely withdrawing the screws *x x x* the door may be taken away: *y y* the floor, below which the box containing the spring is placed: *z* the door-post.

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N° X.

HYDRO-PNEUMATIC APPARATUS.

The SILVER MEDAL *of the Society was this Session presented to Mr.* JOHN CUTHBERT, *of St. Martin's-lane, for a* HYDRO-PNEUMATIC APPARATUS.—*The following communication has been received from him on the subject, and a working Drawing of the Apparatus is placed in the Society's Repository.*

113, St. Martin's-lane, London,
April 13, 1819.

SIR;

I BEG leave to offer to the Society for the Encouragement of Arts, Manufactures, and Commerce, a combination of the blow-pipe and pneumatic trough invented by me. The utility and simple arrangement of which I hope will meet with their approbation.

It is a well known fact that in chemical analysis the blow-pipe is indispensably necessary; and the almost constant application of the pneumatic trough need not be enlarged upon. The apparatus I lay before the Society combines these two instruments in one, and when required for either purpose, can at once, without any trouble, be dismounted, and the pieces applied to their separate uses.

To a public lecturer, who often at the time of exhibiting the effects of gas, may have occasion for a blast-pipe, this combination is of infinite advantage, by reason of the

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facility with which oxygen gas from a bladder may be introduced and passed through the platina jet, which cannot be fused by the heat required.

When the apparatus is used as a pneumatic trough, it is only necessary to remove the mouth-pipe and cover; which latter, when taken off, becomes a useful tray for transferring the receivers from the pneumatic trough, the ledge of the cover being sufficiently deep to contain water for that purpose.

The water from the bottom vessel may be occasionally forced up by the mouth, in case of a deficiency when many receivers are in use, and is kept up to the height required, by means of a sliding-pipe within the large tube *f f*; and if the contrary effect is necessary, by depressing the sliding-pipe, any quantity of the water may be let off at once into the lower vessel. By this means a constant accession or diminution of the water is in the operator's power, without delay, or the assistance of a second person.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.

JOHN CUTHBERT.
Philosophical Instrument-maker.

References to the Engravings, Plates XIV *and* XV.

Plate XIV (fig. 1) is a view of the apparatus, as a blowpipe with the air vessel *b* thrown open to show the tubes within. Through the tube *d d* which descends within a quarter of an inch of the bottom of the air-vessel, the air is conveyed from the mouth. The tube *e e* is to carry the air from the vessel *b* through the jet to the lamp; this tube contains another tube, which slides air-tight into it, and is shown by fig. 6; to the extremity of this, a transverse tube (fig. 7) is connected. To the movable

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one is attached the jet *k*, which, by turning in an opposite direction to that required when it is in use, is capable of shutting off the air, as it becomes a stop-cock, by means of the hole *h* in the tube.

The large tube *f* is to let the water down from the broad part of the pneumatic trough, to force the air from the air-vessel, through the centre tube *e e*.

The upper part of the tube *d d*, is capable of being removed to admit the pipe of the bladder (pl. XV, fig. 6), which fits air-tight into it, by which means oxygen gas may be forced into the air-vessel (the common air being first displaced) which will render the flame particularly effective where great heat may be necessary.

The lamp and tray *l* are placed on the cover of the blow-pipe, so as to allow the wick to stand immediately before the jet. The jet tube *e* can be raised or lowered for the purpose of depressing or elevating the flame, as occasion may require; *m* is a shade to prevent the breath from agitating the flame which is attached to the tube *d d*, and may be removed back at pleasure.

Fig. 3 is a section of the instrument in use, showing the water descending from the upper part through the large tube into the lower vessel *b*, and forcing the air above its surface, through the center tube to the lamp.

Fig. 2 is the apparatus employed as a pneumatic trough for collecting gas, by means of the short sliding tube, shown in fig. 7, which fits into the large tube *f* (fig. 2), and is furnished with the cap *n* (fig. 7) to prevent the water being thrown over the upper edge of the trough when forced up from the air-vessel, by blowing through the tube *d* (fig. 1).

Fig. 8 is a ground plan of the cap *n* of fig. 7. One of the advantages of this construction is, that in filling a large receiver with water from the trough, the

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deficiency of the fluid can be supplied by raising it from the lower vessel by the breath, and it is retained in the upper compartment of the trough by the sliding tube *n* (fig. 7) being drawn up above the surface of the fluid.

When the water in the receiver is displaced by the gas, the redundancy is let off into the lower vessel by the same tube.

By this contrivance, the necessity of pouring in or emptying out water through the help of another vessel is obviated, and the operator relieved from that inconvenience.

The broad surface of the upper part of the pneumatic trough is particularly adapted to keep the pressure of water equal on the air, which produces a uniform flame, the altitude of the water being little affected, as well as presenting the most convenient form for pneumatic purposes.

Fig. 4 is the cover of the apparatus inverted, which becomes a tray to which the receivers may be transferred when filled with gas.

The two tubes *o* and *p* are to prevent the water which is in the tray (to keep the receivers air-tight) from passing through the holes.

Fig. 9 is a ground plan of the lamp on a movable shelf.

Fig. 10 is a side view of the movable shelf and lamp.

Plate XV, fig. 1, is a perspective front view of the apparatus, to show the movable shelf, and the manner of attaching it to the tubes *e* and *f* by the bayonet catch, as it may be necessary to employ the lamp when the cover is in use as a tray.

Fig. 2 is a perspective side view of the same.

Fig. 6 is the bladder of gas, with a stop-cock and connecting pipe.

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Fig. 5 is a gas-holder that fits into the well of the pneumatic trough, with an attached stop-cock *t*.

Fig. 3 is the same vessel inverted, the stop-cock being removed, and the aperture made water-tight by the screw *s* (fig. 4); by the addition of a movable shelf, it becomes a small pneumatic trough.

Fig. 4 is a section of the above, showing the trough furnished with its shelf and a hemispherical chamber *r*, connected to its under side, to insure the gas from the retort to pass only through the hole in the shelf, as also effectually to prevent the retort from slipping out of its position.

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N° XI.

LIFE RAFT.

The GOLD MEDAL *of the Society was this Session voted to Mr.* THOMAS COOK, *Lieut. R. N. for a* LIFE RAFT.—*The following communication has been received from him on the subject, and a Model of the Raft is placed in the Society's Repository.*

32, Church Path, Portsea,
March 29, 1819.

SIR;

WITH the utmost deference I beg to submit for the information and consideration of the Society of Arts, &c. a plan of my invention for the construction of a life-raft in case of shipwreck, which I am desirous to offer to the maritime world under the patronage and through the instrumentality of the Society, should it meet their approbation. This simple plan, the accompanying model on a scale of two inches to a foot, representing the raft ready for launching overboard, will clearly explain. Two sides of the canvas (containing holes for the men to sit in, with strengthening bands for them to sit on) are nailed, the other two sides laced to a square frame, which takes apart at two corners, that it may be rolled up with the canvas in a very small compass. The casks (those used for holding the ship's water) are secured by slings and a frapping line. This raft has the advantage of being fitted in a few minutes, at a time when a few minutes might decide the fate of the crew, who are not required to lash themselves, but merely to sit astride on the bands, being

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well buoyed up, and to remain quiet till driven on shore by the wind and waves; neither can they be washed off, if ever so benumbed with cold.

As few merchant vessels will require one so large as to carry 25 men, coasters and small vessels can make them according to their respective complements. One of 7 feet square will carry 13 men. One of 4 feet 6 inches square, will carry 5 men, with casks in proportion.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOMAS COOK.

Lieut. R. N.

References to the Engraving, Plate XVI.

Fig. 1, *a b* the two sides to which the canvas is nailed. *c d* the other two sides of the frame to which the canvas is laced. The sides *a* and *c* are secured together by a rivetted bolt at *e*, and the sides *b* and *d* at *f*. The other two corners take apart (the bolts being only secured by a pin which hangs by a chain) in order to fold up, in which case the side *c* turns on the center *e*, and lies on the side *a*; and is there secured by the bolt *g*, as fig. 2; and the sides *d* and *b* are secured together as at *h* (fig. 2); it is then rolled up and tied together by the lacings. The bands across the holes on which the men sit go quite across the canvass, as shown at *i i i* (fig. 2), and on each side of the holes are rope handles for the men to hold by *k k k k*; the four casks are secured to the frame by slings and a frapping line, as shown more clearly (fig. 3), which is a side view of the raft on a level with the eye of the spectator.

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N° XII.

LIFE RAFT.

The GOLD MEDAL *of the Society was this Session voted to Mr.* W. RODGER, *Lieut. R. N. for a* LIFE RAFT.—*The following communication has been received from him on the subject, and a Model of the Raft is placed in the Society's Repository.*

28, Suffolk Street, Charing Cross,
May 4, 1819.

SIR;

THOUGH many ingenious plans for the purpose of saving shipwrecked seamen have at different times been suggested, it is still to be lamented that they have not had the desired effect, as plainly appears by the number of lives lost annually. And it is the more to be regretted, as it must be evident to every person who has had an opportunity of examining the plans alluded to, that their failure cannot be attributed to any real defect in their construction, but to the inattention of ship-owners, in allowing their vessels to go to sea unprovided with the materials requisite for the purpose; or to the unwillingness of seamen to take them on board. From my own experience I can affirm that it is with great reluctance seamen admit any thing on board a ship which cannot be applied to some useful purpose daily, and which may be termed ship's furniture. This I am convinced, any person acquainted with nautical affairs will allow to be the case,

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which being taken for granted, leaves little room to expect much advantage to be derived from any plan, though ever so ingenious, unless every ship is already provided with the means of constructing it. Under these circumstances, and with the hope of alleviating the sufferings of those who may have the misfortune to be wrecked, I have constructed a raft capable of carrying thirty men; the model of which (on a scale of an inch to a foot) I herewith transmit, and which I beg you will do me the honour to submit to the consideration of the Society for the Encouragement of Arts, &c. To obviate the objection before-mentioned, I have constructed it of materials which every vessel is obliged to take to sea for other purposes, viz. butts, slings, capstan bars, gratings or hatches, and handspikes, lashed together with small rope or gaskets. Casks of any size may be used; and small spars, such as boats masts, top-gallant studding-sail booms, top-mast studding-sail yards, and many more which it is unnecessary to enumerate, may be substituted for capstan bars. That being the case, every vessel has the means of constructing a sufficient number of rafts to carry the whole of her crew, in the event of being wrecked; therefore, all that is necessary is, to explain how those means are to be applied so as to be at once simple and efficacious. The raft here proposed is intended to be constructed upon deck in the following manner: whilst part of the crew are getting the casks out of the hold, let the rest get the capstan bars, gratings, handspikes and lashings ready, which being done, lay two capstan bars *a a* (plate XVII), parallel to each other about six feet apart, on which place three gratings *b b*, and lash them together; then lay two more capstan bars *c c* athwart the ends of the former, one on each side of the gratings, and secure them with good lashings, which will form a square platform for the men to stand on. In the next place let a butt *d* be se-

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cured to each side of the square by means of the slings *e e*. At the same time, part of the crew may be employed in forming a square (on the other side of the deck), with four more capstan bars *f f f f*, which is to be placed on the top of the casks, and frapped down to the lower square; this will keep the casks outside of the platform, and leave plenty of room for the men to sit or stand, without danger of being bruised. For further security, a handspike *g g g g* may be lashed to each corner of the raft, and a life-line *h h h h* passed round it, and made fast to the upper end of the handspikes, which will be about four feet above the platform; and for further security may pass obliquely to the corners of the four upper capstan bars. Life-lines may also be led athwart the platform, for the men to hold by. The raft being constructed, it is hoisted out by means of two whips, one on the main stay, hooked to two pair of slings *i i i i*, fastened to the corner of the raft; or (if the masts have been carried away) launched overboard by hand.

The buoyancy of four butts, each capable of containing 108 gallons (ale and beer measure) is equal to the weight of thirty men nearly, supposing each man to weigh 150 lbs.; but, as the casks, if not totally immersed, will tend to break the sea, I would not recommend it for more than twenty men; the casks will then be at least a foot above water; and if the men sit on the gratings, and thereby displace a greater quantity of water, the raft will float much lighter and safer. It may also be used for landing troops on a beach, when there is too much surf to perform that service in boats, or to embark them in the event of an enemy of superior force coming up in the rear. Having tried it nearly two years ago, alongside of H. M. S. Northumberland at Sheerness, I herewith transmit captain Walker's certificate, which I beg you will lay before the Society. I have now only to state, that should it meet with the

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approbation of the Society, I shall feel much pleasure in attending the Committee, and giving any further explanation they may require.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WM. RODGER.

CERTIFICATE.

I DO hereby certify that a raft invented by Lieut. Wm. Rodger, R. N., and constructed of such materials as every ship carries to sea, viz. 4 butts, 4 pr. of slings, 8 capstan bars, or small spars, 3 gratings, and 4 handspikes, secured by lashings of small rope or gaskets, was tried alongside his Majesty's ship Northumberland, under my command, with twenty men on it, which number it appears calculated to float with; and it is my opinion that it would be useful in landing troops on a beach, when there is too much surf for boats to perform that service; and that it might also be used in landing from a wreck.

Given under my hand on board H. M. S. Northumberland, June 1, 1817.

JAMES WALKER, *Captain.*

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N° XIII.

COUNTING MACHINE.

The GOLD ISIS MEDAL *of the Society was this Session voted to* BRYAN DONKIN, *Esq. of Bermondsey, for a* COUNTING MACHINE.—*The following communication has been received from him on the subject, and one of the Machines is placed in the Society's Repository.*

Bermondsey,
May 5, 1819.

SIR;

I REQUEST that you will lay before the Society for the Encouragement of Arts, Manufactures, and Commerce, the accompanying Counting Machine of my invention. I shall be happy to attend the Committee with a full description and explanation of the same whenever they may please to appoint.

I am, Sir,
&c. &c. &c.
BRYAN DONKIN.

A. Aikin, Esq.
Secretary, &c. &c.

This machine is applicable wherever it may be desirable to keep an account of the number of revolutions or strokes which may be made by the wheels or levers of any other machine in a given time or space; as for instance, the number of revolutions made by a mill wheel, or of the strokes of a steam-engine beam in a given time, or the number of revolutions made by the wheel of a carriage or perambulator on passing over a certain space. In the first

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case, we know, that if the machine to which the counter has been applied, has, during any given period, performed a certain number of movements, a corresponding quantity of work either has been, or ought to have been done. And in the latter case, by inspecting the counting machine, we learn that a wheel (whether of a carriage or perambulator) of a known diameter, has made so many revolutions during its passage from one place to another, and from thence we easily determine the distance between the two places.

This machine, as well as all others used for a similar purpose, depends upon the well-known principle of relative motion, which may be familiarly exemplified by the three hands or indices of a clock or watch, in which one is a counter of seconds during a minute, another of minutes during an hour, and the third of hours throughout the day. Various mechanical expedients of more or less complication, have been resorted to for producing the like effect, and it is the novelty and simplicity of the mechanical expedient alone in which it differs from other machines.

The nature of the expedient, and the description of the machine will perhaps be more easily understood by first stating, without reference to the drawings, that in this machine ratchet wheels are employed, and that these wheels are moved one tooth at a time, by means of clicks appended to a lever. The number of teeth in each of the ratchet wheels, and also the number of ratchet wheels are determined by the extent of the number of revolutions or strokes intended to be counted. For example, if we wish the machine to count to 100, we might easily make one wheel with 100 teeth answer the purpose. But if the counting is to be continued to 10,000, or 1,000,000, it becomes almost impracticable to make a wheel with such a number of teeth, of any moderate diameter. Let us suppose two wheels of 100 teeth in each to be employed;

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it is evident that by moving one of the wheels one tooth at a time, by every motion of the lever, it will count a hundred during one revolution. And if, on completing every revolution of the first wheel, the second wheel is made to move one tooth, it is also evident that the second wheel will count the revolutions of the first, or so many hundreds. So that the two wheels would together count to one hundred times 100, or 10,000. In like manner, if three wheels be employed, the third wheel would become the counter of the revolutions of the second, and the enumeration would be carried on to 1,000,000, and so on by a greater number of wheels to any assignable extent.

The plates XVIII and XIX contain representations of this machine made in two different ways. The machine exhibited in plate XVIII is made with three wheels, such as are generally termed contrate, where the teeth of each are formed on one side. The machine represented in plate XIX, is made with the same number of wheels, having their teeth formed upon the edge of each. In plate XIX, fig. 6, is a segment of one of the wheels, where the shape and position of its teeth are shown, and also the lever and click for moving the wheel: *l* is the lever; *c* the pin upon which it moves; *d* is a click, hung by the pin *e* to the end of the lever; *f* is a small spring applied so as to keep the click upon the wheel, and cause it to fall into the teeth successively, as the lever is drawn forward and backward. In this fig. only one click can be seen, but the end of the lever is made wide enough to receive three clicks (that is, one for each wheel) as shown figs. 7 and 3. Fig. 8 is an edge view of *a*, one of the ratchet wheels; *b* the arbor upon which it is fastened; and *c* is an index or hand fixed upon the end of the arbor. Fig. 9, is an edge view of a circular piece of brass, whose diameter is rather larger than that of the ratchet

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wheel, and when in its proper place, is fixed upon the side of the wheel *a*, and exactly concentric therewith. Fig. 10, *d* is another ratchet wheel; *e* is a socket upon which the wheel is fixed, having a hole through it of a proper size to receive the arbor *b* of the wheel *a* in fig. 8: *f* is an index fixed upon the end of the socket *e*. Fig. 11 is another circular piece of brass similar to fig. 9, and it is also in a similar manner fixed to the side of the wheel *d*. Fig. 12, *g* is another ratchet wheel, with a socket and index. The hole through the socket of this wheel is large enough to receive the socket of the wheel *d* in fig. 10. Fig. 5 is a section of the wheels &c., the axis of the wheels being in the plane of the section: *a d g* are the wheels, and 9 and 11 are the two circular pieces of brass. The piece 9 is fixed by screws to the wheel *a*, and the piece 11 is made fast in a similar manner to the wheel *d*. The wheels are held between and made to turn in two plates *e f* and *h i*. These plates are kept at a proper distance from each other by three pillars (as shown in figs. 1 and 4; one of which pillars is also shown in fig. 3, at *p*), and upon which they are fastened by screws. A hole is made in the center of the plate *h i* to receive the lower end of the arbor *b*, in fig. 8; and there is also a hole in the center of the plate *e f* through which the socket of the wheel *g* passes, and in which it turns. The three hands, or indices, are shown above the plate *e f*. The lowest or shortest of which is connected to, and turns with the wheel *g*. The middle hand with the wheel *d* and the upper one being fixed upon the arbor *b*, it turns with the wheel *a*. Fig. 2 is a plan of the upper side or face of the plate *e f*, upon which are drawn three concentric circles, with 100 divisions cut upon each, corresponding with the number of teeth in each of the ratchet wheels: *g*, *d*, and *c*, are the three hands which apply themselves to the divisions of the inner, middle, and outermost circles respectively. Fig. 1, is a plan of the machine as it would appear when

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the indices and the plate *e f* in fig. 5, are removed: 1, 2, and 3, are the three pillars: *a* one of the ratchet wheels; *l* the lever; *c* the pin upon which the lever turns; *r* the click; *s* the spring: *t* is a spring, the end of which bears against the end of the lever *l* in such a manner as that whenever the lever is impelled by the hand or otherwise, so much forward as to cause the ratchet wheel, by means of the click, to move one tooth forward, it may, by the action of the aforesaid spring *t*, be restored to its former position; for, by being so restored, the click will be drawn back over the next tooth in the wheel, and be thereby enabled to push the wheel forward by another movement of the lever: *s* is a check spring, of which there are three, namely, one to each wheel; they are fastened to one of the pillars, as at 1, and their other ends fall into the teeth of the wheels in such a manner as to prevent them from being turned the wrong way by the click, as it returns over the top of each tooth. In fig. 4, one of the circular pieces of brass is shown at 11, 11. It has before been said that there are two such pieces; their situations have been pointed out, also how they are affixed to the ratchet wheels (one upon *a*, the other upon *d*), and that they are a little larger in diameter than the wheels to which they are so affixed. It is also necessary to state, that after the pieces are affixed to the ratchet wheels, a notch is cut upon the edge of each piece, so as exactly to correspond in shape and place with one of the spaces or notches between two contiguous teeth in the ratchet wheel, as is shown at *n* in fig. 6, where a segment of the wheel and piece is seen. It has also been said that three clicks are appended to the lever *l*. These clicks are shown in fig. 7, at 1, 2, 3. This figure is an edge view of a portion of the three ratchet wheels *a d g*, and of the two pieces 9 and 11. The click 1 is made to fall into the teeth of the wheel *a*. The end of the click 2 is extended or widened, so as to apply itself

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over both the ratchet wheel *d* and the circular piece 9; and the end of the click 3, being made still wider, applies itself over the ratchet wheel *g*, the circular piece 11, and also over the end of the click 2. It must here be observed, that that part of the extended end of the click 3 which lies over or upon the click 2, must be bent up, so as to allow 3 to fall low enough into the notch in the circular piece 11 and into the teeth of the wheel *g*. It will be understood from the above description, that as it is intended to move the ratchet wheels but one tooth at a time by every motion or stroke of the lever, the angular motion of the lever must be limited so as to make the clicks carry forward the wheels only one tooth. It will also from thence be understood that as the click 1 rests only on the teeth of the wheel *a*, it will cause the wheel to be moved forward one tooth at every alternation or stroke of the lever; and the wheel *a* will carry with it the piece 9 (the piece and wheel being united together) and that the index *c* will count the units up to 100. Now, as the click 2 lies over the piece 9 as well as over the ratchet wheel *d*, it will be evident that as there is only one notch in the circular piece 9, the click 2 can only fall into the said notch and into a tooth of the ratchet wheel *d*, once for every revolution of the wheel *a* and piece 9; consequently the wheel *d* can only be moved one tooth for each revolution of the wheel *a*. Thus the index *d* in fig. 2 will count the revolutions of the wheel *a* up to 100. In like manner the click 3 can only fall into the teeth of the wheel *g* once for every revolution of the wheel *d* and piece 11; consequently, the index *g* in fig. 2 will count the revolutions of the wheel *d*, up to 100. It has been stated in the above description, that the extended end of the click 3 should be made to lie upon that of the click 2. The reason for this is not very obvious; but the necessity of its doing so arises from the following circum-

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stances, which occur at a certain period of the counting, by the then relative situation of the click 3, and the notch in the circular piece 11. It is evident that the wheel *a* moves one tooth forward for every motion of the lever; and also, as the notch in the circular piece 9 is exactly opposite the space between the 99th and 100th teeth of the wheel *a*, that whenever the wheel *a* has been driven forward 99 teeth, the notch in the piece 9 will have been brought to the situation where the click 2 will fall into it; as also between two of the teeth of the wheel *d*; so that by the next motion of the lever, both the wheels *a* and *d* would be moved forward one tooth; that is, *a* would have completed one revolution, and *d*, by being moved one tooth, registers the revolution of *a*, or 100. By the next motion of the lever the wheel *a*, piece 9, and consequently the notch in 9, are carried forward one tooth, and on the lever falling back, the click 2 is drawn out of the notch, and rests upon the edge of the circular piece 9, by which it is held above the teeth of the wheel *d*, and therefore cannot again move that wheel until the notch in 9 is brought round a second time. But the circumstances are not the same with regard to the wheel *d* and the click 3; for the wheel *d* stands still, whilst the wheel *a* makes $\frac{99}{100}$ of its revolution, and moves with it only through the remaining $\frac{1}{100}$th. Now, suppose the wheel *a* to have made 99 revolutions, the wheel *d* would have been carried forward 99 teeth; but the notch in the circular piece 11 would then be in the situation to allow the click 3 to fall into it at the next movement of the lever, and the wheel *g* would be thereby moved before it ought; and instead of the machine indicating the number 9901, as it ought to do, it would falsely report the number 10,001. Therefore to prevent the click 3 from falling into the wheel *g* before the wheel *a* has completed another revolution, the end of the click 3 is made to rest

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upon that of the click 2, and thereby it can only fall into the wheel *g*, when the click 2 falls into the wheel *d*.

In order to fix the indices or hands to the zero points of the circles on the face of the machine, the wheels *a* and *d* must be turned round until the clicks all fall into the notches, and the lever is pushed forward. The lever may then be allowed to fall back; and if in this situation the hands *g d c*, in fig. 2, be fixed upon their arbor and sockets respectively and made to point to zero or 0, the machine is ready for counting. The units up to 100 are read off upon the divisions of the inner circle; the hundreds up to one hundred hundreds, or 10,000, upon those of the middle circle; and the tens of thousands up to 1,000,000, upon the divisions of the outer circle, according as the situation of the several hands may indicate.

The principle and construction of the machine represented on plate XIX, having been, it is hoped, clearly described, it only remains to say, that plate XVIII contains drawings of a machine differing only in modification from the former one. The drawings themselves being sufficiently explanatory, it is only necessary to state that this modification produces a more compact arrangement of the wheels, &c., and that the wheels being divided upon their faces, the numbers can be read off in one line by the index at *a* in fig. 1.

Fig. 1, is a plan of the machine.

Fig. 2, is a section of the same.

Figs. 3 and 4, are a plan and edge view of the lever and clicks, and fig. 5, is also an edge view of the clicks.

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N° XIV.

SELF-ADJUSTING CRANE.

The SILVER MEDAL *of the Society was this Session voted to Mr.* A. AINGER, *of Everett Street, for the Model of a* CRANE.—*The following communication has been received from him on the subject, and the Model is placed in the Society's Repository.*

Everett-street, Russel-square,
March 24, 1819.

SIR;

HEREWITH you will receive the model of a crane, on the principle of self-adjustment, which I will thank you to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce.

I am, Sir,
&c. &c. &c.
A. AINGER.

A. Aikin, Esq.
Secretary, &c. &c.

References to the Engraving of Mr. AINGER'S *Crane, Plate* XX.

Fig. 1 is a side view, and fig. 2 is a direct view of the instrument.

The working parts of the crane consist of the rope barrel *a*, having on its axis the wheel *b*, the teeth of which take into those of the pinion *c*. On the axis of this pinion are fixed the two ratchet wheels *d d*, situated as described in fig. 2. This axis extends beyond the faces of the

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ratchet wheels, to receive the levers *f f*, which would move freely without affecting the wheels but for the clicks *e e* in their upper ends, which on the motion of the lever in one direction, pass freely over the ratchet teeth, while in the other, they catch in them and carry the wheel a portion of a revolution. The levers are worked by the winches *h h*, and the motion is communicated from them by the bars *g g* attached to weights (one of which is seen and marked N° 1) sliding on the levers. From the situation of the winches, which are connected together by a spindle common to both, it will be evident that the two levers are always moving in contrary directions, thereby preserving a nearly continued motion in the wheels, and consequently in any weight attached to the rope *q*.

These comprise the whole of the parts necessary to raise the load. The means by which the effort applied at the winch *h* is made uniformly equivalent to the various weights with which the machine is liable to be loaded, depends on the application of a principle which was first directed to this purpose in a communication published in the 36th volume of the Society's Transactions. The following apparatus is necessary to its adoption in this case.

The two arms *i i* swing on the axis of the rope barrel, and are connected together by a bolt, the end of which is seen immediately above the roller *k*; under this roller, the rope carrying the weight to be raised, passes. The tendency of the rope to assume a straight line occasions a consequent tendency to elevate the roller, and with it the arms *i i*, to which are attached a weight *l* equal to the smallest load to which the crane is required to adapt its powers. The situation of the arms *i i* in the elevation (fig. 1), is supposed to be the lowest they can take; and a load equal to the weight *l* is imagined to be on the rope *q*. By means presently to be described, the sliding weights are

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both retained at N° 1 on the levers *f f*. If a load double the former, or twice the weight *l*, is to be raised, it will have the effect of elevating the roller one-half of the difference between its former situation and that which it would assume if the rope formed a straight line as *r a*. The rope will therefore take the situation marked by the fraction $\frac{1}{2}$, while the weights on the levers will remove to twice their former distances from the centers of the ratchet wheels marked 2. The weights descend by their own gravity, but are limited in that descent by being attached to small ropes or chains *v v*, one of which is seen in the elevation fig. 1. They pass over pullies *w w* and from thence through vertical holes in the lower halves of the axes of the ratchet wheels, which project beyond the upper for that purpose; they then go under rollers in the weights, return through the vertical holes before described, and are then respectively fastened. The other ends of the ropes are wound round the external faces of the double fusees *o o*, in such a manner that the developement of the rope commences from the apex. In the ends of the arms *i i* are placed pullies *t*, under which small ropes or chains, similar to *v v*, pass, having the one end of each fixed to the frame, the others passing in the direction *s n* over the internal faces of the fusees. It will be seen by inspection of the engraving, that while the rope *s* is in the act of being wound on to the largest volute of the fusee, the rope *v* is detaching itself from the smallest. But if a weight which will give the arms *i i* their greatest elevation be on the rope, the fusees, after having performed half the revolutions they are intended to make, will then begin to change this effect, and the ropes *v v* will be delivered from the largest volutes, while those marked *s* will be received on to the smallest. A load four times the weight *l* will cause the rope to be in the situation marked $\frac{1}{4}$. One double the last, or eight times the weight *l*, will place the

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rope at $\frac{1}{8}$, and the consequence of the action of the fusees will be, that while the removal of the roller *k* from 1 to $\frac{1}{2}$ caused the sliding weights to move only from 1 to 2 on the levers, the elevation of the roller from $\frac{1}{4}$ to $\frac{1}{8}$ will permit the descent of the weights through the space between 4 and 8; thus preserving a constant equilibrium between the load to be raised and the power of the machine.

The roller *m* is placed with its lower surface in the same horizontal plane as the top of the rope barrel, in order that the rope may form similar angles with the horizon on each side of the roller, a circumstance necessary to the accurate application of the principle.

The weight may be lowered in the usual way by a brake-wheel, first detaching the clicks *e e* from the ratchet teeth.

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N° XV.

SWEEPING CHIMNIES.

The SILVER MEDAL *of the Society was this Session voted to Mr.* W. FEETHAM, *of Ludgate-hill, London, for his Method of* SWEEPING CHIMNIES.—*The following communication has been received on the subject, and a set of the Apparatus is placed in the Society's Repository.*

9, Ludgate-hill,
Oct. 16, 1818.

SIR;

I REQUEST that you will lay before the Society of Arts, &c. the accompanying models and apparatus illustrative of my mode of cleaning the flues of chimnies. I have for some time made use of it in my own house to my entire satisfaction, and am therefore desirous that an opportunity should be offered to the public of comparing it with those other machines which are intended to effect the same desirable object, namely, to supersede the necessity of employing climbing boys.

I shall be ready to attend the summons of the Committee to explain the manner of using the apparatus, and generally to furnish all the information on the subject which may be in my possession. It would, perhaps, be an additional satisfaction to the Committee to see the apparatus in actual use; if so, it will give me great pleasure

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to receive them at my house any day that they may please to appoint.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. FEETHAM.

In order to sweep a chimney from the bottom, it is necessary to have a light, strong, flexible rod, with a brush at the end, long enough to reach from the bottom to the top of the flue, flexible enough to adapt itself to the various curvatures and angles of the flue, and strong enough to allow of being pulled up and down with considerable force, in order to overcome the resistance of friction. But in many high flues with sharp angles, this is impossible; another method has therefore been had recourse to: this is, to tie a ball to the end of a rope, and let it down from the top of a chimney to a person at the bottom. A brush is secured to the middle of the rope, and thus, by the persons at top and at bottom drawing the brush to them by pulling alternately at the rope, the chimney is effectually swept. By this method, however, especially where the chimnies are high, as in London, the person at the top of the flue runs considerable risk of falling, particularly in windy weather; and the slates or tiles are liable to be broken where there is not a clear passage from the trap-door in the roof to the stacks of chimnies.

Mr. Feetham's method consists in dividing the length of the flue, by inserting a door in the attics or garret, and then by means of a brush on a rod introduced through this door, to sweep the upper part of the flue, and, by means of a brush fixed to a cord, to sweep the lower part.

If the flue is very crooked, or is horizontal or nearly so in any part, it will be necessary to insert another door, through which a brush or scraper may be introduced; but

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for the generality of dwelling-houses one door to each flue will be found quite sufficient.

References to the Engravings, Plate XXI.

Fig. 1, 2, two chimney flues shown partly in section.

a a a cast iron frame let into the flue, and properly secured; it is situated either above the roof, or in the garret or attic story, as is most convenient.

b a shutter of sheet iron, fitting accurately into the frame *a*, and furnished with an aperture and slides, through which the rope of the descending brush, or the flexible rod of the ascending one may be worked without any soot escaping into the room.

c a cast iron door, by which the aperture into the flue is kept closed.

Fig. 3, the descending brush formed of iron wire, having four round brushes of whalebone *e e e e*, twisted in with the wire, *f* an iron ball rolling on a swivel, and suspended to the brush by means of a chain.

d a pulley, over which the rope *g* (fig. 2), for working the brush passes. It is seen in its place (fig. 1) on the inside of the flue, and is attached by a short bar to the frame *a*.

Fig. 4, the ascending brush fixed to a rod of cane, which is strengthened without impairing its flexibility by an iron wire twisted spirally round it. *h* (fig. 1) shows the brush in the flue with the handle passing outwards through the aperture of the shutter.

i (fig. 1) a scraper of iron fixed to a flexible rod, and worked through the door *k*, to remove the soot from the horizontal part of a flue, which cannot be swept by the descending brush.

Fig. 5 shows the manner of joining two flexible rods. *l* a ferrule and socket; *m n* the two spiral wires, the one fitting into the interstices between the coils of the other.

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N° XVI.

PORTABLE LITHOGRAPHIC PRESS.

Mr. R. ACKERMANN, *of the Strand, London, having presented to the Society of Arts, &c. a* PORTABLE LITHOGRAPHIC PRESS, *the Invention of M.* SENEFELDER, *the* THANKS *of the Society were voted to Mr.* ACKERMANN *for his Present, and a Description of the Press was ordered to be published in the ensuing Volume of Transactions.*

Strand,
May 5, 1819.

SIR;

I BEG the favour of you to present, with my most sincere respects, to the Society of Arts, &c. a Lithographic Press, the invention of Mr. Alois Senefelder, whom they have distinguished by their Gold Medal; such distinction must be highly flattering to him, and their acceptance of this curious and most useful machine will be equally so to me, as I was, in some measure, the instrument by which the Society were induced to become the patrons of his Invention. I beg leave to add, that in the use and application of this press, I shall be ready to give every instruction and assistance that may be required of me.

I am, Sir,
&c. &c. &c.
R. ACKERMANN.

A. Aikin, Esq.
Secretary, &c. &c.

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References to the Engravings, Plate XXII.

Fig. 1 shows the press open; *a a* the stone on which the drawing is made, secured to the lid by the dovetails *b b*, between which it slides; *c c* a frame on which the leather is stretched, to hold the paper for the impression (it is shut down on the box when in use, but is now open to show the other parts); *d d* a narrow ridge which travels from one end of the box to the other, and thereby successively presses every part of the leather and paper which is on it against the stone, as shown in section, fig. 2; *e* a winch-handle which turns the axis *f f*; to this axis are fastened three straps; the other end of the two outer ones are fastened to the ridge *d d* (shown in the bird's-eye view, fig. 3); when the axis is turned, it winds up the two straps, and pulls the ridge to that end of the box, and at the same time unwinds and gives out the middle strap, which passes under a wire *g* (fig. 2), and goes along the bottom, and round another wire *h*, and is fastened to the middle of the carriage *i i*; and on turning the axis the reverse way, it winds up the middle strap, and draws the carriage and ridge back again: the bottom of the carriage is cut away in the middle to clear the strap, as shown separate fig. 4. The ridge *d d* is rounded at bottom, to let it ride equally against the stone.

Fig. 5 shows the stone and frame of leather separate.

Figs. 2 and 6 show the manner the stone is secured down by the lever *k*; it presses on the ridge *l*, and is buttoned down at *m*; *o* (fig. 2) is a hook to lift up the stone, which also serves as a foot to keep it level, as in fig. 1.

Fig. 7 is the inking roller; *n n* two loose necks of leather, to prevent friction in the hands.

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N° XVII.

PUMP.

The Sum of TWENTY GUINEAS *was this Session voted to Mr.* WM. AUST, *of Hoxton, for a* PUMP *on a new construction, invented by him. The following communications have been received on the subject, and a Model of the Pump is placed in the Society's Repository.*

55, Allerton-street, Hoxton,
Jan. 5, 1819.

SIR;

I BEG leave to submit to the Society of Arts, &c. the model of a pump, which accompanies this communication. The advantages which this my invention possesses over pumps of the ordinary construction depend on the curvilinear form of the barrel, which allows, and, indeed, obliges the rod, the handle, and the lever on which it works, to be all in one piece. Hence results not only a much greater simplicity in the workmanship, and consequent cheapness, but a greater steadiness and precision of action, whereby more water is discharged, and the leathering of the valve will last a much longer time without wanting repair. The cost of a pump of this construction, 2¼ inches in the bore, will not exceed 3*l.*, and the weight of the barrel, which is of brass, is not more than 3 lbs.

The accompanying certificates from Messrs. Sewel, Barwick, and Tyer, will, I trust, be considered as satisfactory; and I am further authorized to say, that either of

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those gentlemen will, with great pleasure, exhibit to the Committee the pumps which I have fixed up for them at their respective premises.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. AUST.

CERTIFICATES.

No. 11, Tyndall Place, Islington,
March 4, 1819.

SIR;

I VERY readily comply with your request in speaking of the merits of the circular barrel pump of your invention, set up in my garden a year and a half ago. I can truly affirm, that it works easier, and with a greater power than the common lift pump; may easily be kept in repair, and is capable of being applied as a forcing pump. You are at liberty to refer to me.

I am, Sir,

Mr. Aust. &c. &c. &c.

WM. JAS. SEWEL.

No. 62, Old-street, St. Luke's,
March 4, 1819.

SIR;

THIS is to certify that I have had a circular barrel pump of the invention of Mr. Aust in use nearly two years, and have found that it answers every purpose I expected completely; it works easier, and its power is greater than the common pump, and from its simplicity of principle appears easily repaired, but that I have had no occasion to try.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JAMES BARWICK.

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Homerton, Hackney,
March 5, 1819.

SIR;

I HAVE had one of Mr. Aust's circular barrel pumps in use for several years, and am rather surprised they have not been in general use, as they work remarkably pleasantly, and are not likely to get out of order. The barrel is a segment of a circle, and the piston works from a centre describing the same curve as the barrel of the pump, so that the pressure of the leather of the piston is equal, and produces a better vacuum than the common pump does, and it discharges more water in proportion to its size.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.

G. TYER,
Master of the Workhouse.

The Committee proceeded to inspect two of Mr. Aust's pumps, which he has put up for Mr. Sewel and Mr. Barwick.

At Mr. Barwick's, notwithstanding the awkwardness of the situation in which it was necessary to place the pump, and which compelled Mr. Aust to make the handle too short, and to bend the supplying pipe to a right angle just at the place where it is soldered to the barrel, the pump performs its work easily and effectually.

At Mr. Sewel's the pump is put up in his garden, its bore is 2½ inches; it raises water from a tank to the height of 15 feet, and, under the disadvantage of an angular junction of the pipe with the pump, it works very well. It has been 18 months in use, and has required no repair.

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References to the Engravings, Plate XXIII, XXIV.

Plate XXIII, fig. 1 a view of the pump.

Fig. 2 a section of do.

Fig. 3 a view of the flat plate of iron to which the pump is fastened, the barrel and pipe being removed.

Fig. 4 shows the pivot on which the lever of the handle works, and its connexion with the flat plate.

a a the barrel forming a curve of a quarter of a circle; fixed at its upper end to the head *f*, and at its lower to the pipe *b*.

b b the pipe that conducts the water into the barrel; it is made curvilinear, in order that as little obstacle as possible may be opposed to the ascending water.

c c c the piston, the handle, and the lever on which it works, all in one piece; the piston part is curved to correspond with the curvature of the barrel.

d the pivot on which the lever of the handle works.

e a flat plate to which the whole apparatus is fastened, and which may itself be screwed to a block of wood fixed against the wall.

Fig. 5 a view of the barrel.

Fig. 6 a view of the pipe with the valve attached to its upper end.

Fig. 7 the box of the piston.

Figs. 8 and 9 a back and front view, and fig. 10 a section, of the valve.

Fig. 11 shows how the barrel of the pump is formed; a circular semi-cylindrical piece of brass is first cast, and is afterwards divided into four equal pieces at the parts *g g g g*. These pieces are then cemented by pairs, forming tubes or barrels a quarter of a circle in curvature, so that each circular piece makes two barrels.

Plate XXIV shows the method of rectifying and

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finishing the circular pieces (pl. XXIII, fig. 11) after they have been cast.

Figs. 1 and 2 a lateral and vertical view of the apparatus.

A a turning lathe.

a a the maundrel on which the circular piece *b b* is fixed.

B the tool.

Figs. 3 and 4 a lateral and vertical view of the tool B.

c c the stem, its upper part being cut off obliquely.

d a circular plate, toothed on its under side, and movable round the central pin *f*, which screws into the plate *l*, and thus keeps the whole steady.

e the point by which the tool acts on the barrel *b b*, fig. 4.

g a screw for adjusting the point *e*.

h an endless screw fixed on the axis *i i*, and governed by the handle *k*. This screw takes into the teeth of the plate *d*, and thus brings the point *e* in contact with any part of the barrel.

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N° XVIII.

THREE-WHEELED CLOCK.

The SILVER ISIS MEDAL *was this Session voted to Mr.* JAMES FAYRER, *of Pentonville, for an improved* THREEWHEELED CLOCK.—*The following communication has been received from him on the subject.*

40, White Lion Street, Pentonville,
Jan. 20, 1819.

SIR;

I BEG leave, through your medium, to present to the Society of Arts, &c. a very simple sidereal regulator, with the description and annexed drawing.

I am, Sir,
&c. &c. &c.
JAMES FAYRER.

A. Aikin, Esq.
Secretary, &c. &c.

ASTRONOMERS of the present day complain of the superiority of their instruments over their clocks. Therefore, the value of any improvement upon them will appear obvious. The month clock, from its complexity, is liable to many errors (as will be hereafter shown); the eight-day, likewise; and of the three, Dr. Franklin's two-wheeled clock is the best, owing to its admirable simplicity; but, in consequence of many objections, it has never been put in practice for astronomical observations; the principal of

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which are, the inconvenience of frequent winding up, and uncertainty as to the particular hour shown by the index. These objections led the ingenious Mr. Ferguson to endeavour to remedy these imperfections; but clocks made upon his construction, he candidly acknowledges have two disadvantages, from which Dr. Franklin's are free. "The swing wheel cut into 90 teeth will cause the pendulum to describe small arcs in its vibration, and therefore the momentum of the ball will be less, and the times of vibration will be more affected by an unequal impulse of the swing wheel on the pallets." Since my worthy friend Mr. Troughton placed the celebrated cutting engine (made by the late Mr. Rehe) in my possession, many gentlemen have applied to me, and have had wheels cut for the same purpose of simplifying the clock; but all have followed the same error as Mr. F., by having the swing wheel cut into too many teeth; some have gone as far as 300, in order to give the train a slow motion. This will readily be conceived to produce an erroneous escapement; besides, the circle will require to be divided into 600 to show the seconds; this would produce a confusion which persons employed in making astronomical observations would endeavour to avoid. In 1811 I cut two sets of wheels upon Dr. F.'s plan for Dr. Dartnell, which led me to do the same for myself, and therefore I caused one to be made in the following year, with the addition of a double barrel and counter-weight, instead of a pulley, for the convenience of winding up and making it go longer. This clock, with a deal pendulum, has gone ever since with a weight of 2 lb. 3 oz. vibrating in an arc of 4° 30′. A weight of $4\frac{1}{4}$ lb. (insufficient for a week clock made in the best manner, with 4 holes jewelled, and ruby pallets) increased the arc of vibration to 7°. It has long surprised me by the accuracy of its going, and when it is considered that the barrel is but half the usual

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diameter, the excellence of its going must be solely attributed to the simplicity of its construction; for the workmanship, I must confess, cannot be expected to contribute to its goodness, when it is understood that it was made by my son, in the first year of his apprenticeship. The above observations led me to consider how far these clocks are capable of improvement, so as to render them useful to the science of astronomy. I do not expect that future time will be able to add much to the correctness of the workmanship of the present day; therefore, all my hopes rest in simplifying their construction, to bring them nearer to that point of perfection which every person engaged in making regulators would wish to attain. The candid declaration of Mr. F. determined me not to increase the teeth of the swing wheel, but to enlarge the center one; which I have accordingly done, to 240, with a pinion of 10 and the next wheel to 150, which has the effect of keeping it going two hours longer in each revolution; and by reducing the barrel to half the usual size, and giving 32 revolutions, I gain what is requisite to keep it going eight days; for the hours in that time being 192, the barrel turning once in 6 hours, $32 \times 6 = 192$; and the turns on the barrel being 32, the only method that ever has been in practice to wind up clocks of this construction is by a pulley and counterweight. By the following method, however, they can be wound up the same as other 8 day regulators. On the opposite end of the barrel to the ratchet, a small wheel is cut with a coarse tooth of any number, and on the squared arbor is fixed a wheel of double the diameter and number of teeth; thus the barrel goes twice round for the winder once. To prevent the winding-wheel and barrel touching each other, except when winding up, the shoulders of the arbor are turned away sufficiently for the winding-wheel to clear the barrel, by means of a spring on the backplate. It is forced forwards when the winder is applied,

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and the usual pressure is sufficient to connect the wheel, and thus the winding up is effected without disturbing the minute hand, and the clock is kept going during the time of winding, in the same manner as the best regulators. In constructing this clock, my wish was, to make it as simple as possible for showing sidereal times, and I have divided the circle into 360; but doubtless many gentlemen will prefer the minutes as usual, which can be done by fixing a pinion on the second wheel that goes round in 15 minutes, consequently it would require a wheel four times in diameter and number to carry the minute hand. This would give them the appearance of the three-wheeled clocks, and would add but little friction; indeed, clocks made on this construction will admit of many varieties, and should this be found to possess the advantages which I flatter myself it does, month clocks will in future be made with three wheels and three pinions. The errors of the wheels and pinions having never been materially attended to by artists, it becomes a matter of some consequence to endeavour to find their quantity, and the effect they have on the performance of the clock. Each wheel and pinion having their errors, and these errors causing a difference in the maintaining power, this must have some small influence on the going of the clock; or why, it might be asked, do month clocks go more imperfectly than eight day ones? the only answer that can be given appears to be that the moving power or weight is removed to a greater distance from the swing wheel, and from these errors arise a greater inequality of force upon the pendulum; this will be illustrated by the following experiments, not less important than novel, which were made with a view to ascertain the weight which the month, eight day, and Franklin's clocks would require, in order to move their respective trains (disencumbered of the pallets and pendulum) from a state of rest.

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to that of motion. The first experiments were made on a month clock made by Shelton, and in 1805 repaired by Arnold, at a considerable expense, with new swing wheel and pinion, 6 holes jewelled, ruby pallets, &c. &c. The four wheels and pinions were cleaned and fresh oiled, and put in their proper places. I then proceeded to apply small weights until I found the swing wheel move. By stopping it at different points of its revolution, I found, with some surprise, that it moved on one side from 90° to 120°, and then made a dead stop, repeating this until I found the effect was the same at different parts of the next wheel. I further increased the weight until I found it overcame all resistance. Now the difference between the increased weight, and the weight that moved the swing wheel from 90° to 120, constitutes, in my opinion, the error of the swing-wheel pinion. Now this difference of 13 oz., every minute, in one case accelerating, and in the other retarding, it is not perhaps possible to say what influence it might have upon the going of the clock; but when this retarding and accelerating force was either opposed or assisted by the errors of the next wheel and pinion, which was found to be almost 3 oz., it will not be considered presumption in me to think that it would have the effect of disturbing the pendulum. But if it is further considered that as the wheels revolve in such different periods, in some cases the sum of all their differences, which would be more than 1 lb. avoirdupois, might be all plus, and in others minus; in such cases little doubt can be entertained that this difference in the maintaining power would be instrumental in disturbing the regularity of the clock's going. After ascertaining the error of the swing wheel it was removed, and the error of the next wheel and pinion found in the same manner, and so on till the train was reduced to two wheels and two pinions. To all persons engaged in making time keepers, I would recom-

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mend the experiment to be made upon movements intended for regulators or chronometers, that the errors may be reduced to as small a quantity as possible. Equalizing the swing or balance wheels appears to me no more necessary than reducing the errors. By so doing we shall remove that irregularity upon the pallets or balance, which produces an unequal arc of vibration. The method that I have pursued for finding the errors is as follows: Upon the pulley I suspend two small bags, and with small shot increase the weight leisurely until it and the swing wheel nearly equipoise, then I run the wheels, and stop them at intervals until the barrel has made one revolution. By this means I ascertain where the wheels and pinions are the freest, and consequently the least weight that will move them; in the second bag I put weight sufficient to overcome all resistance. Consequently the second bag must contain the errors, and the sum of both bags and the pulley, the weight requisite to move the swing wheel from a state of rest to that of continued motion. The advantages of this method will be illustrated by the following statement: The clock which I have the honour to present to the Society contained upon first trial the following errors: first bag 2 oz. second bag $1\frac{1}{7}$ oz. $= 3\frac{1}{7}$ oz. But after correction the error was found to be, first bag 1 oz. 8 dr. the second 8 dr. = 2 oz. nearly. Suppose 2 lb. was sufficient to keep the clock going, then the first error would be equal to the 21st part of that weight; the second evidently reduces the error to the 64th part of the maintaining power, which almost brings it to a nominal value. The plan I pursued in removing the above errors was, to examine each wheel with the greatest nicety, and to remove any preponderating side that might be found on them. After which, still observing errors, which I attributed to the teeth of the wheels and pinions; I replaced each pair, and gently re-

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volved them, by attaching small weights. I thus obtained in a very nice manner all the hard parts which were marked, and afterwards polished down until the whole revolution was made with nearly equal facility. By thus proceeding, I materially diminished the errors; but to eradicate them completely, would be a task I conceive totally impossible. It is also highly important to observe whether the hands are perfectly balanced, most particularly the second one, as a very small difference in either would cause an immense alteration in the maintaining power. A small error will also arise by the weight shifting its place on the barrel, one pivot of which is turned smaller than the other. This is done with a view to lessen the friction. But there appears to be a strong argument against its utility. The weight in its progress from one end of the barrel to the other, passes from the larger to the smaller pivot, and there being a difference of diameter between them, and consequently unequal friction, it must cause an irregularity in the pull. I endeavour to avoid this in the regulators which I have made by turning the pivots of equal diameter, and cylindrical like the axis of a transit instrument. With regard to pendulums, I consider the simple mercurial one to be the best. But it is plain since my experiments on wheels and pinions (proving unequal impulses), that it has no superiority over the most common in correcting them; nor will any pendulum do this. Therefore it is but reasonable to infer that these errors of the wheels have misled the judgment with regard to the effect of different pendulums in preserving the point of oscillation at equal distance from the point of suspension, under the various degrees of heat and cold which might take place during the time they were under trial. It is worthy of remark, that as the minute and short hand revolve once in six hours, there cannot be so great a difficulty in reading the

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time as there is in Dr. Franklin's, where the hand goes round in four hours, consequently there must be three rows of figures. Nor can there be so great a possibility of making mistakes, because the period of time is greater between them. For instance, the time shown by the position of the hands is eleven minutes 30 seconds past 1 or 7, making a difference between them of six hours. In Dr. Franklin's the same position of the hands would have been 11′ 30″ past 1, 5, or 9, making a difference of 4 hours only. If what I have advanced should not be sufficiently explanatory, I shall be happy to attend to give any further elucidation that may be requisite. A sincere wish to benefit science has been my object in constructing this clock, and if I should be so happy as to gain the approbation of the Society of Arts, &c. my highest hope will be accomplished.

References to the Engravings, Plate XXV.

Fig. 1 represents the dial plate, with the method of showing the hours, minutes, and seconds.

Fig. 2 is a side view of the clock, where *p* is the pallets, *a* the swing wheel of 30 teeth; *b* the middle wheel of 150 teeth; *c* the center wheel of 240 teeth; *d* the pinion, with the shoulder that the hand is fixed upon, 42 teeth; *e* the hour wheel turned by the pinion *d*, 168 teeth; *m* the barrel with 32 turns; *n* the barrel ratchet; *o* the going ratchet wheel; *s* the spring on the back plate that forces the winding wheel forward to clear the end of the barrel; *l* the balance of the minute hand.

Fig. 3 *f* the winding wheel, 48 teeth; *g* the end of the barrel, 24 teeth; *k* the stop acting upon the going ratchet wheel *o*.

Fig. 4, *i i* the springs acting upon the wheel *c*, to propel the train forward during the time of winding up.

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Fig. 5 represents the method of conducting the arbor through, and keeping the barrel up to the wheels by the collet and pin in front *w w*.

Fig. 6, *z* the stop to prevent the barrel from over winding; *y* the pin that *z* stops against; the axis of *z* will be seen distinctly by referring to *r*, fig. 2.

Fig. 7, *e* is a front view of the hour wheel, upon the extremity of which are engraved the 24 hours; these are seen through the orifice in the dial plate *a*, fig. 1. The same letters refer to all the figures.

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N° XIX.

INVERTED PENDULUM.

The GOLD ISIS MEDAL *of the Society was this Session voted to Mr.* WM. HARDY, *of Clerkenwell, for an* INVERTED SPRING PENDULUM.—*The following communications have been received on the subject, and the Instrument is placed in the Society's Repository.*

28, Coppice Row, Cold Bath Square,
April 7, 1818.

SIR;

I REQUEST of you to have the goodness to lay before the Society of Arts, &c. a simple instrument, contrived by me to ascertain whether a pendulum vibrating communicates a motion to the place to which it is fixed. To know this must be esteemed a very essential point, for unless that part be altogether immoveable, the result of experiments with the pendulum will not be conclusive. This instrument herewith sent, will determine this point to the greatest certainty. Major Kater can testify the advantage he derived from it in fixing up his pendulum for the experiments in which he has been recently occupied.* Dr. Hutton says that it will be a useful instru-

* "Though there was little reason to imagine that the vibrations of the pendulum could communicate any motion to a support so firm as that which has been described, it became a point of considerable importance to verify this by actual experiment. For this purpose I had recourse to a delicate and simple instrument, invented by Mr. Hardy, clock-maker, the sensibility of which is such, that had the slightest motion taken place in the support, it must have been in-

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ment to ascertain the attraction of heavy bodies. It will also serve as a very accurate level; for by dividing the inch on the scale into minute parts, the index will show how much the part on which it is placed deviates from the horizontal position: in this case it will be necessary (in order to get it more delicate and sensitive) to screw up the ball so that the spring below may have no more power over the ball than sufficient to recover itself to the perpendicular; but when it is made use of to a pendulum, it must be adjusted accurately to vibrate seconds with it. The three brass screws on which the instrument stands, are screwed into the frame, and serve to adjust it to the level wheresoever you place it. I have had orders for many of them, and have sent some to Russia, among which was one for admiral Greig, commander of the Russian squadron in the Black Sea.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WM. HARDY.

CERTIFICATES.

Bedford Row,
26th November, 1818.

THIS is to certify, that I have several times, with much satisfaction, examined a neat little instrument, invented

stantly detected. It consists of a steel wire, the lower end of which is inserted in a piece of brass which serves as its support, flattened so as to form a delicate spring: on the wire a small weight slides, by means of which it may be made to vibrate in the same time as the pendulum to which it is to be applied as a test. When thus adjusted, it is placed on the material to which the pendulum is attached; and should this not be perfectly firm, its motion will be communicated to the wire, which in a little time will accompany the pendulum in its vibrations. This ingenious contrivance appeared fully adequate to the purpose for which it was employed, and afforded a satisfactory proof of the stability of the point of suspension."

PHIL. TRANS. *for* 1818.

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by Mr. Hardy, chronometer-maker, which he calls a vibrating spring pendulum, being a delicate, vertical, vibrating spring, which I very much approve of, as I think it may be useful on many occasions.

CHARLES HUTTON, *LL. D. F. R. S.*

Fleet Street,
25th November, 1818.

THIS is to certify respecting the ball and spring apparatus, invented by Mr. Hardy, that ever since it was known to me, I have used it to ascertain the steadiness of my clock; and such is its delicacy that in my house, which is shaken by the passage of carriages, I seldom find it at rest until after midnight.

I may add, that I consider its use as important, not only for the above purpose, but also generally to prove the firmness of machinery wherever that may be a desirable object.

EDW. TROUGHTON.

East Sheen,
SIR; 9th December, 1818.

I HAVE accidentally heard this day, that the merits of your inverted pendulum, or noddy, are to be considered this evening at a meeting of the Adelphi Society, of which I am a useless member, on account of the distance at which I live from town. I take leave, however, to make known a new application of your contrivance, which I have successfully made to a transit-circle, lately made for me by Mr. Thomas Jones of Charing-Cross, and which promises to be essentially useful in astronomical observations. I cannot describe in this letter, dispatched in haste, the particular manner in which the inverted pendulum, attached to the vernier bar, acts as a *monitor* to give notice when any particular star is in the field of view of

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the telescope; but you will have some idea of its utility and mode of application, if I tell you, that the point of the inverted pendulum is adjusted to a vertical position, so as to point to zero on an ivory scale when the telescope points to the horizon, and that when any particular star is wanted to be viewed in a given altitude, the scale of the vernier is clamped to the graduated circle on the axis of the transit, *at that altitude;* in which case the pendulum is turned aside, out of its vertical position, but is enclosed in a surrounding tube of glass; then the moment that the telescope is elevated, by a slow gradual motion, to its required altitude, the ball of the pendulum strikes the side of the glass tube, and indicates, by such audible blow, that the star is then in the field of view. I have mentioned this contrivance to Mr. Troughton, who is highly pleased with it, and thinks with me, that it will become a useful appendage to astronomical instruments with revolving verniers, and will moreover be no bad substitute for a plumb-line or level, in adjusting the position of the vernier, when extreme accuracy is not required. Should this additional claim to public notice be considered as enhancing the value of *your invention,* I hope the Committee will not overlook it.

I am, Sir,
&c. &c. &c.
W. PEARSON.

References to Mr. HARDY'S *Spring Pendulum, Plate* XXVI.

a a the base of the instrument.

b b two mercurial levels attached to the base.

c c c three adjusting screws, by means of which and the levels, the perfect horizontality of the base is secured.

d a pillar screwed into the base, and terminating in an

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arm to which is screwed the plate *e*. On the surface of this plate is described a graduated arc; and two pins *ff* are inserted into its extremities, in order to limit the vibrations of the pendulum.

g a brass plate screwed into the base *a*, with a socket in its center for receiving the flat steel spring *h*; the other end of the steel spring is fixed into the rod *i* of the pendulum: this rod is cylindrical, screwed at its superior extremity, and terminates in the pointer *k*. The ball *l* is moveable on the rod, and is adjusted by means of the milled head screw *m*.

n n is a glass cover to protect the instrument from currents of air and accidents.

N° XX.

REPEATING ALARUM.

The sum of FIFTEEN GUINEAS *was this Session voted to Mr.* THOS. TAYLOR, *of the Royal Observatory Greenwich, for a* REPEATING ALARUM, *adapted to astronomical purposes.—A Model of the Alarum is placed in the Repository of the Society, and the following communications have been received on the subject.*

Royal Observatory, Greenwich,
Jan. 22, 1819.

SIR;

I HAVE herewith sent you the model, together with the drawing and description of a repeating alarm clock of my own invention, which may be set on going to bed to discharge twenty or more alarms during the night at any

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particular times required; and have to request that you will be pleased to lay the same before the Society for the Encouragement of Arts, &c. Before I proceed to give a description of the drawing, allow me to mention the circumstances which led to the construction of the instrument. In the year 1807, I was appointed assistant at the Royal Observatory, in which situation I had frequently to make several observations during the night; and for this purpose my bed-room was furnished with one of the common alarm clocks, which I soon found inadequate to my wants; for if, on going to bed, I set my clock to the first observation which occurred, and through profound sleep did not hear the alarm, not only that observation, but probably the succeeding ones, would be lost. Even if the alarm awoke me, on seeing that it was cloudy, I had then to procure a light and set my alarm again for the next observation, and so on. This suggested to my mind the advantage to be derived from a repeating alarm, if it could be so made that on going to sleep it might be set to discharge at several times during the night. I made inquiry of several of the eminent clock-makers, but could get no information of any thing of the kind being ever effected. I therefore about the year 1810 resolved to make an attempt myself, and after various devices, a plan at last suggested itself, which I was fully persuaded would answer. I accordingly presented a drawing, with a description thereof, to the astronomer royal, who laid the same before the president and council of the Royal Society, and they were pleased to grant permission that one should be made for my use.

I gave the necessary direction to Mr. Johnson, clock-maker in the Strand, and in a few weeks the clock was completed, and proved to be of such use that a second was made for the astronomer royal; and two others were shortly afterwards ordered by Dr. Robertson, professor of

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astronomy at Oxford. The testimonials of these gentlemen I have sent herewith, which I presume will suffice to prove the utility of the invention to the practical astronomer. But I should have mentioned, that in addition to its being a repeating alarm, another advantage is secured by this instrument. It is well known that in an observatory, it is necessary to observe the right ascension of several stars when they pass the meridian, both by day and night, for the purpose of regulating the clocks; and the stars generally made choice of are 36 that were first selected by Dr. Maskelyne, known by the name of Dr. Maskelyne's Catalogue; now five minutes previous to the meridian passage of each of these stars, a hammer is made to strike on the bell, to give the astronomer notice thereof, should he be writing or calculating at the time. I shall not enter into a detail of any other cases in which it may be of use, but only add, that to every one who may have occasion for an alarm, I flatter myself it will be considered by your Committee as far superior to those in common use.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOS. TAYLOR.

CERTIFICATES

Royal Observatory, Greenwich,
Jan. 19, 1819.

I DO hereby certify, that, in the year 1812, two repeating alarm clocks were made for the use of the Royal Observatory, under the direction of Mr. Taylor, and which I believe to be his own invention.

They have been constantly kept going, and fully answer the end for which they were designed, inasmuch that I have to express my highest approbation of the same.

J. POND.

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Observatory, Oxford,
Jan. 16, 1819.

In the year 1812 two repeating alarm clocks, constructed according to the invention of Mr. Thos. Taylor of the Royal Observatory, Greenwich, were procured for the establishment under my superintendence. Since that time, one of them has been kept constantly going in my room, and the other in that of my assistant, and they have been found very useful, and fully adequate to the important purposes for which they were made.

A. Robertson,
Professor of Astronomy, Oxford.

P. S. I think there is considerable merit in the invention of these repeating alarm clocks.

References to the Engravings, Plate XXVII.

Fig. 1 is a front view of the dial-plate, which is divided into 24 hours, and each hour into 5 minutes. The hours are placed in an inverted order when compared with those on fixed dial-plates.

Fig. 2 is a front view of the works when the dial-plate and front plates have been removed.

Fig. 3 is a plan or vertical view on the upper side of the clock.

Fig. 4 is a side view of the works of the alarum *only*, which in their natural position are placed on the right hand of figs. 1 and 3.

The same letters of reference refer to the same parts in each figure.

The going movement resembles that of a common clock, except that, instead of an hour hand, the dial-plate A is made to revolve once in 24 hours. It is keyed to the arbor of the great wheel B sufficiently tight to be

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carried round with the arbor, yet may be moved at pleasure to any point. The time is shown by an index *a* screwed to the top of the frame or front plate C C. This plate is fixed, and kept parallel to the second plate D D by four pillars and screws *b b b b*. The plate C C has an opening in the center equal in diameter to that of the dial-plate, through which the dial-plate is seen to revolve. The back-plate E E, likewise, is fixed and kept parallel to the second plate D D by four pillars *c c c c*. To the side of the wheel B is fixed a spring and catch, acting on the catch-wheel F: this catch-wheel is fixed to the pulley G, over which the cord H, with the weight attached to it, passes. When the weight is raised, the catch-wheel and pulley are at liberty to turn on the arbor; but while the weight is descending, the wheel B and the dial-plate turn with it. I is the second wheel, J the third wheel, K the escape wheel, and L the pallets of the going movement.

M is the great wheel of the alarum part, having on its arbor a catch-wheel, pulley, cord, and weight, fitted up in a manner similar to that already described. To the back part of the wheel M is fixed a rim or wheel N (as shown by the dotted line within the great wheel) having two gaps or notches *x y* on its periphery. The wheel M carries the pinion *o*; and on the same arbor is fixed the escape wheel P, having a pin or stud *e* on the side of the wheel. Q is the pallet; R the alarm hammer, the shank of which is fastened to the back of the pallet-arbor at *f*. When the pallet is put in motion by the escape-wheel, the alarm-hammer vibrates in the inside of the bell S. T is a hammer or lever turning on a pin or fulcrum at *g*, which is fixed on the front side of the plate D D: the shorter end or tail *h* of the hammer is acted on by a pin *i*, screwed into the dial-plate for this purpose. As the dial-plate turns, the pin *i* depresses the tail *h* of the hammer (as represented figs. 1 and 2) till the pin passes over it, and

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allows the end of the hammer T to fall on the pin *j* in the end of the arm which is fixed on the arbor *k k*. This arm being depressed by the momentum of the hammer, lifts at the same time the two detents *l m* (also fixed on the arbor *k k*), upon which, the pin *e* in the escape wheel being free, and the detent *m* being lifted out of the notch *y* in the periphery of the wheel N, the alarm is set in motion, and the edge of the rim of the wheel N sustains the detent till the great wheel M has made half a revolution. At the same time the detent *l* has been kept up high enough for the pin *e* in the escape-wheel Q to pass under it, whereby the alarm has been kept in motion about 24 seconds of time, and during half a revolution of the great wheel M. When the notch *x* has revolved to the place of *y*, then the detent *l* stops the pin *e* in the side of the escape wheel Q, which immediately stops the alarm.

In order to discharge the alarm at various times, the dial-plate is pierced with screwed holes on the inside of the divisions at every 10 minutes distance, so as to admit the pin *i*, which is screwed next to the head. A number of these pins being prepared, one of them is screwed into each of the holes in the dial-plate, nearest to the times when the alarum is required to be discharged; and as the holes are 10 minutes apart, the discharge may be regulated to within four minutes previous to the time of any observation.

At one end of the arbor U is fixed the shank of the hammer V, and at the other end an arm or lever *n*, which is acted on by a number of fixed pins projecting on the inside of the dial-plate near the edge. As soon as any one of these pins comes in contact with the end of the arm *n*, it elevates the hammer V till the pin is at liberty to pass over the end of the arm; then the hammer falls and gives the bell one blow. These pins are inserted in such places that the hammer will fall five minutes previous to

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the passage of each of the following stars * over the meridian. When this has not been thought sufficient to awaken the attention of the observer, an alarm has likewise been set to discharge at that time. If, however, the observer should wish not to be disturbed by the hammer V striking stars, a pin *o* is fixed in the upper end of a lever which projects over the front of the top plate at S, *p* being the fulcrum, and *q* a stud fixed in the lower end of the lever. When the pin *o* in the upper end of the lever is turned to N, the stud *q* acts against the arm *n* and depresses it, as is shown by the dotted line; consequently, the pins fixed on the inside of the dial-plate will pass over the arm *n*, and the bell will remain silent.

* Names of Stars.	Sidereal Time of passing the Meridian.
	h. ′
α Arietis	1 57
α Ceti	2 53
Aldebaran	4 25½
Capella	5 3½
α Orionis	5 45½
Sirius	6 37
Castor	7 23
α Hydræ	9 19
Regulus	9 59
β Leonis	11 40
Spica Virginis	13 15½
Arcturus	14 7
α Libra	14 41
α Corona Borealis	15 27
Antares	16 18½
α Herculis	17 6½
α Ophiuchi	17 26½
γ Draconis	17 52
α Lyræ	18 30½
γ, α Aquilæ	19 37½
α Capricorni	20 7½
α Cygni	20 35
α Aquarii	21 56½
Fomalhaut	22 47½
α Andromedæ	23 59

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N° XXI.

IMPROVED AXLE FOR CARRIAGES.

The SILVER MEDAL *of the Society was this Session voted to Mr.* R. PHILLIPS, *of Addle-hill, for his* IMPROVEMENTS IN THE CONSTRUCTION OF CARRIAGES, *so as to prevent them from overturning in case of the Axle-tree or Perch-bolt breaking. A Model exhibiting these Improvements is placed in the Society's Repository, and the following communication has been received on the subject.*

Addle-hill, Doctors' Commons,
March 21, 1819.

SIR;

I BEG leave to lay before the Society for the Encouragement of Arts, &c. a model of a safety carriage of my invention, intended for a stage coach. The construction is such as to prevent it from falling when the axle-tree breaks; it also possesses the peculiar advantage of being able to continue the journey when the above accident happens. Even if the perch-bolt should break, the carriage is secured from accident by means of a hollow tube which the bolt goes through, and answers the same purpose. The model accompanies this letter, and I will gladly attend the Committee if they should please to

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examine its merits, at any time that they may choose to appoint.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. RICH. PHILLIPS.

References to the Engravings, Plates XXVIII *and* XXIX.

Plate XXVIII, fig. 1, a bird's eye view of the wheels, &c. of the carriage.

Fig. 2, elevation of part of the fore axle-tree and one wheel.

a a a a four plate iron *cuttoos* fixed to each end of the axle-trees.

b b the bolt which passes through the perch and fore axle-tree, and on which the axle-tree turns.

c (fig. 2) the end of an iron plate fixed to the bottom of the perch, and projecting through the axle-tree; it is retained in its position by an iron pipe *d*, through which the bolt *b b* passes.

Plate XXIX, fig. 1, elevation of part of the hind axle-tree.

Fig. 2, section of the same through the dotted line *o o*, fig. 1.

Fig. 4, longitudinal section of fig. 1.

a a the cuttoo.

e the nave of the wheel.

f the iron axle, bolted in firmly between a double tree, by the two iron straps and screws *g h*.

i i an iron plate fixed on the axle-tree by the plate *h* and the screw *k*.

l l another iron plate fixed under the axle-tree by the above-mentioned straps and screws *g h*.

To the upper plate *i i* the *cuttoo a*, which is made in two pieces, is bolted by the nut *m* and the cross plate *n*,

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and to the under plate *l l* by the bolts *q q*, the connecting plate *p p* (shown separately fig. 3) and the nut *r*.

s s s three bolts passing through the nave, by means of which and their nuts, the circular plate *t t* is firmly fixed to the nave. Hence, if the iron axle should break, this plate retains the nave within the *cuttoo*, and not only prevents the carriage from falling, but will allow it to proceed to the end of the stage in safety, though heavily, on account of the friction of the plate upon the neck of the *cuttoo*.

w the middle or great bolt of the axle-tree.

Fig. 5 a section through the perch and front axle-tree.

b b the bolt, which lies in the hollow *x x*.

c c an iron plate bolted under the perch.

d d an iron pipe (shown separate fig. 7) forming part of the hollow *x x*, and passing through the thick end of the bolt *c c*. By this contrivance, in case the pin *b b* should break, the bolt *c c* and the pipe *d d* would connect the perch with the axle-tree almost as securely as the bolt itself on the usual construction.

v a nut which screws on to the end of the pipe *d d*, and thus keeps it in its place.

Fig. 6 a plan of the plate *c c*.

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N° XXII.

GUNPOWDER MILL.

The SILVER MEDAL *of the Society and* TWENTY GUINEAS *were voted this Session to Mr.* JAMES MONK, *of Tonbridge, for a Method of Diminishing the Hazard both to the Workmen and Machinery in case of an Explosion taking place during the Grinding and Mixture of the Materials for* GUNPOWDER.—*A Model of the Apparatus is placed in the Society's Repository, and the following communications have been received on the subject.*

Marybone-park,
March 11, 1819.

SIR;

HEREWITH I trouble you for our manager, Mr. James Monk, with the drawing, model, and description of a machine, invented, I have not the slightest doubt, by himself, for lessening the effects of explosions in double gunpowder-mills, and which, as I have truly stated in the certificate, has several times proved its efficiency.

As my partners and myself have been most desirous that the invention should have publicity, in some measure to lessen the risk to the workmen employed in such manufactories, we have presumed to recommend to

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Mr. Monk to offer it to the Society for the Encouragement of Arts, Manufactures, and Commerce; and should the Society concur with us in the utility of the invention, some mark of its approbation will, we trust, be shewn to its inventor.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JAMES BURTON,

for BURTON, CHILDREN, & BURTON.

CERTIFICATES.

Marybone-park,
March 11, 1819.

SIR;

I DO hereby certify that the machine, of which a model and drawing accompanies this, was invented (to the best of my knowledge), and put up by Mr. James Monk, the manager, at the gunpowder-mills of Messrs. Burton, Children, and Burton, near Tunbridge, about three years since (to each of four *double* mills there). That since that time occasional explosions have taken place, which before generally took effect on the powder under both pairs of Stones; but since that time, by the effect of instantaneously wetting the powder under the contrary pair of stones, to those where the explosion had taken place, a double disaster has been prevented. And I am convinced it has much lessened the personal risk of the workmen employed.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JAMES BURTON,

of the firm of BURTON, CHILDREN, *and Co.*

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British Museum,
March 9th, 1819.

SIR;

I HEREBY certify, both from my inspection of your ingenious invention for preventing explosion during the manufacturing of gunpowder, and from my knowledge that accidents have frequently been avoided since it was adopted in the Tunbridge mills, that it is fully adequate to answer the purpose for which it is intended, and is, as far as I can judge, a valuable contrivance for the preservation of the workmen's lives, and the security of the adjoining mills.

I am, Sir,

To Mr. Monk, &c. &c. &c.

&c. &c. JOHN GEO. CHILDREN,

one of the Proprietors of the Tunbridge Mills.

Tunbridge,
March 12, 1819.

I FULLY concur in the assertions of my two partners relative to the entire invention of our manager, Mr. James Monk, at our gunpowder-mills, and I also state to have observed the preservation of one mill after the explosion of that adjoining, when there could be no doubt that the safety of the mill-man, who was at the time in the mill which did not explode, was owing to the fall of water on the charge of powder having been quicker than the embers of fire from the mill exploded.

WILLIAM FORD BURTON.

Partner BURTON *and Co.*

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References to the Engraving of Mr. MONK'S *Gunpowder-mill, Plate* XXX.

Fig. 1. *a a* a compound lever formed of two iron bars, the extremities of which terminate above the bedstones of the pair of mills A B, here represented.

b a bolt securing the adjacent ends of the two lever bars, but allowing them to move so as to form a very obtuse angle, when a power acting from below upwards, is applied to either of the ends *a a* of the lever, as shown by the dotted lines.

c c two oblong holes in the lever bars, through which two screws are put, which being received into the two uprights *d d*, constitute the two fixed fulcrums of the lever.

e e two uprights, with an eye in each to receive and steady the ends of the lever; the eyes being long enough to allow the bars to take the position indicated by the dotted lines.

f f two iron rods screwed fast, one at each end of the lever, and suspending the two blowers *g g*. These blowers are made of thin sheet iron, in the form of hollow three-sided pyramids, and are rivetted to the suspending rods: they are placed as near the tops of the upright stone shafts as possible, and as close to the wheels as the timber will allow.

h h two copper chains attached by one end to the lever bars, and by the other supporting two copper valves (*i* figs. 4, 5, 6), in the form of inverted cylindrical cups, about four inches high.

k k two oval tubs capable of holding about six gallons of water, having a circular hole *l* (figs. 2, 4, 5, 6) at the bottom, about six inches in diameter. Surrounding this hole

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is a wooden block fig. 3 (*m* fig. 2), screwed to the bottom of the tub, and having a circular groove or channel capable of admitting freely the bottom of the valve *i*.

n n two small spring catches fastened to two uprights, and shown more at large fig. 7. The lever bars are laid on the top of these catches, so that when the ends of the lever rise, that part of the lever which is on the catch moves downward, as shown by the dotted lines, till it slips over the end of the catch; and thus the lever is prevented from resuming its horizontal position, till released from the catch.

In order to fit that part of the apparatus above described for action, bring the lever to a horizontal position, place the valve *i* in the circular channel, at the bottom of the tub *k* so as to cover the hole; fill the channel with mercury, and then fill the tub with water. Hence it is evident that the water is prevented by the mercury from escaping out of the tub, so long as the valve remains in its place. Now, if an explosion happen either in the mill A, or the mill B, the blower *g* hanging over the bedstone, will be thrown up, and the lever will in consequence be brought into the position indicated by the dotted line, and will be retained there by the spring-catches *n n*. At the same time the valves *i i* will be drawn up out of the mercury, and the water in both the tubs will pour down on their respective bedstones, extinguishing in one the enflamed powder, and in the other preventing it from taking fire.

In a certain stage of the grinding, the materials of the powder are apt to clot, and adhere to the runners; parts of the bedstone are thus left bare, and the runner and bedstone coming into contact, an accidental spark may be elicited, and an explosion ensue. To prevent this most usual cause of accidents, Mr. Monk fixes to the axle of the wheel a scraper formed of a curved piece of wood *o o*, shod with copper (fig. 8), which being placed behind, and

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almost touching each of the runners, scrapes off the powder as it collects, and thus keeps the bedstone always covered.

The other parts of the mill present no variation from the usual construction.

p the great wheel.

q q two vertical bevel-wheels fixed on the axis of the great wheel.

r r two horizontal bevel-wheels working in *q q*, and turning the vertical shafts *s s*.

t t two horizontal wheels fixed to the upper part of the vertical shafts, and driving the wheels *u u*. To the shafts of these latter wheels are fixed the runners *v v*, which traverse on the bedstone *w w*.

x x the curbs surrounding the bedstone to prevent the powder from falling off.

The mill A presents a view, and the mill B, a section of the bedstone and curb.

Fig. 2 an inside view of the tub *k*.

Fig. 3 a plan of the block in which the channel is made for receiving the valve.

Fig. 4 a section of the tub and valve.

Fig. 5 shows the position of the apparatus when the valve is closed.

Fig. 6 shows the position of the apparatus after an explosion has taken place, the valve being raised up out of the channel, and the water pouring down on the bedstone.

Fig. 9 shows the manner in which the scraper is connected with the common axis of the runners.

Fig. 10 a bird's-eye view of the bedstone surrounded by the curb; with the runners and the scrapers fixed to the common axis round which they revolve.

Fig. 11 a section showing the valve and the channel filled with mercury, in which the valve lies when the mill is at work.

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This invention, which has hitherto been confined to a single manufacturing establishment, appears already to have saved eight mills, and probably several lives.

Nº XXIII.

GAS-METER.

The GOLD ISIS MEDAL *of the Society was this Session voted to Mr.* JOHN MALAM *of Westminster, for an* IMPROVED GAS-METER.—*A Model of the Machine is placed in the Society's Repository, and the following communication has been received on the subject.*

As soon as coal-gas came to be extensively applied to the purposes of street illumination and to domestic use as a substitute for lamps and candles, it became an object of great importance to the proprietors and managers of the different gas-works to ascertain with accuracy the quantity of gas expended in proportion to the number of jets or burners made use of.

The essential conditions of any apparatus for this purpose are, that the pressure on the gas while passing through the measurer shall at all times be uniform; and that it shall register truly when that pressure is very small, and when the current of gas is very feeble.

The first gas-meter was constructed by Mr. Clegg, and is secured to the inventor by a patent. It consists essentially of a cylinder divided into cells, inclosed and re-

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volving in an outer cylinder, which is less than half filled with water. The gas enters laterally through the perforated axle, into that cell of the inner cylinder, which happens to be nearest the surface of the water. It displaces the fluid from this cell, consequently destroys the equilibrium of the cylinder, and communicates to it a rotatory motion. When the cell, so filled with gas, has made nearly half a revolution, it comes again in contact with the water, which forces the gas out of the cell into the exterior cylinder, from which it passes into the conducting pipes. A train of clock work is placed so as to register each revolution of the interior cylinder; and the cubic contents of this being known, of course the whole quantity of gas passing through the machine in a given time is ascertained.

Mr. Malam's gas-meter is constructed on the same general principles, but with such improvements as induced the Society to confer on him a high honorary reward; but whether the machine, in their opinion so improved, is completely open to public use before the expiry of Mr. Clegg's patent, the Society does not presume to determine.

Secretary.

No. 10, Romney Terrace, Westminster,
March 10, 1819.

SIR;

HEREWITH I have forwarded to you a gas-meter of my invention, capable of supplying four argand burners, each consuming about four cubic feet of gas per hour. In doing so, I am to inform you, that it is now nearly two years since I first put my invention into practice, during which time the action of the meter has been proved in the most satisfactory manner upon the Westminster gas works. I therefore take the liberty of requesting you will have the goodness to let the meter now sent be brought before the Society of Arts for its consideration. The meter herewith sent being one for actual use, I am

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now preparing a model of the same dimensions, partly constructed of glass so as clearly to exhibit its operation; and to the model alluded to, I have also attached a dial, and the necessary wheel-work for pointing out the number of revolutions, and consequently the quantity of gas passing through it in any specified time for supplying one or more burners, which I shall be most happy to present to the Society on receiving their commands for my doing so.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN MALAM.

References to the Engravings, Plate XXXI.

Fig. 1 is a section across the axis of the machine.

Fig. 2 is a section through the axis.

A A is the outer case of the gas-meter, within which the interior cylinder B B revolves upon the pivots *y z* The former of these pivots is attached to the inverted pipe D D, which brings the gas into the central chamber E. Hence it is conveyed by the openings *a, b, c, d,* into the compartments or cells B, K, G, H, in rotation, as each of them rises above the level of the water *x x*. The gas is then discharged into the outer case by the openings 1, 2, 3, 4, from which it passes into the regulator by the pipe L.

M M is the outer case of the regulator which is kept full of water; N N is the inner vessel, attached to the exterior one by the hinge *f f*, so as to allow this part with the cone *g* to rise and fall freely.

O is the pipe which conveys the gas into the interior vessel.

P is the exit pipe which transmits the gas to the burners.

Fig. 3 is a cross section of the valve; the use of which

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is to prevent any gas from passing into the meter, unless a sufficient quantity of water is in the instrument.

R is the inlet pipe to the partition, *i* the cup, *k k* the float, *l l* the clip-pipe which carries off the superfluous water that would otherwise run over through the inverted pipe D till it had attained its level.

Fig. 4 is the dial and pointer which is secured by a strong glass in a brass ring being soldered over it.

Fig. 5 is a section of the counter, showing the wheels and stop.

Fig. 6 is a section of the lever and crank in the trough.

Fig. 7 is a cross section of the crank, the lever, the trough, the wheels, dial and pointer.

The use of the counter is, to register the number of revolutions of the interior cylinder, and, as the capacity of this is known, and the number of teeth in the wheels adjusted accordingly, the dial indicates, on inspection, the number of cubic feet of gas that have passed through the meter since the counter was last set.

Now, supposing the exit pipe R is connected with the great gasometer, or with the street main, and that the gas is flowing in above the partition *h* of the detecting valve, and that there is a proper quantity of water in the machine, the cup *i* will be elevated above the opening in the partition by the float *k*, which, allowing the gas to pass through the inverted pipe D, fills the central chamber E, fig. 1; and, as the opening *a* is above the surface of the water, the gas passes into the compartment G. The water being displaced by the entrance of the gas, and the equipoise being disturbed, the interior cylinder will move on its axis towards the left hand, till the compartment G is filled with gas, the water passing out by means of the exit opening 2. By this time the opening *a* will have sunk beneath the surface of the water, and the opening *b* will have risen above the water, and the gas will continue

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to flow into the compartment H, till the exit opening 2 rises above the water, and allows the gas in the compartment G to escape into the outer case in proportion as the water enters by the opening *a*. So that the compartments on the left hand are in succession emptied of water and filled with gas, while those on the right hand are filling with water which expels the gas into the outer case. From this it is conveyed by the pipe L, fig. 2, to the regulator; the inner division of which it enters through the pipe O, at the entrance of which is a blunt cone, suspended by a piece of wire with swivels attached to the inner vessel N; in this entrance there is a plate with a hole in it, of equal diameter to that of the frustum of the cone, consequently, as the inner vessel rises, the cone closes up the opening in the plate, which action is regulated by the pressure of the gas between the surface of the water and the top of the inner vessel. Thus an uniform pressure is maintained in the inner vessel, and the gas passing from thence by the pipe P to the burners, is also necessarily under the same pressure; the effect of which is, that the flame from the jets is never wavering or intermitting, but always preserves the same height, and with gas of the same quality affords at all times the same quantity of light.

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N° XXIV.

INSTRUMENT FOR THE USE OF SCULPTORS.

The GOLD ISIS MEDAL *of the Society was this Session voted to Mr.* WM. BEHNES *of Newman Street, Sculptor, for an* INSTRUMENT TO BE EMPLOYED BY SCULPTORS *in transferring points upon marble, from original Models, &c. —A working drawing of the Instrument is placed in the Society's Repository, and the following communications have been received on the subject.*

31, Newman Street,
Oxford Road.

SIR;

I BEG respectfully to offer to the notice of the Society for the Encouragement of Arts, Manufactures, and Commerce, a new invented mathematical instrument for the purpose of *ascertaining* and *transferring points upon marble* from original models of statues, bas reliefs, busts, &c. in a manner far superior to any machine now in use.

I hope this machine will not be found unworthy of the attention of the Society, not only as it saves much of the workman's time in removing and fixing the machine for operation, but also as being a simple and correct mathematical instrument.

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The principal circumstances in which it is superior to the machine in common use, are,

First. Its motion is central, by which means the point or needle may be extended or conveyed from one extremity of a statue, bas relief, &c. to the other, without the uncertain method of always placing the machine to a line upon a horizontal stone the whole length of the subject.

Second. By means of a quadrant, the carver is enabled to turn off the point or needle out of his way whilst cutting off the waste, and thereby preventing the removal of the machine until the point be finished; whereas, on the old plan the whole machine has to be removed several times before the operation can be effected, which, consequently, is attended with much loss of time to the workman, and is liable to great incorrectness.

Thirdly. Several points may be taken at one time without removing the machine.

I shall have much pleasure in attending the committee to exhibit the machine, and explain its utility, and point out its superiority over the one now in use.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WM. BEHNES.

References to the Engravings, Plates XXXII *and* XXXIII.

Plate XXXII represents the instrument in use when ascertaining the *points* upon a block of marble, transferred from an original model.

Fig. 1, A A shows, in dotted lines, the position of the instrument whilst obtaining the *point* upon the original model.

Fig. 2, B B the instrument in the same position; but transferred from the original model to the marble, to ascertain the same *point*, or to show the precise quantity of superfluous marble to be cut away.

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Fig. 2, C a part of the instrument sustaining the needle point, represented as turned out of the way, to enable the sculptor to reduce the marble without obstruction: this can be brought down again without loss of time, as often as may be required to obtain the *point correctly*, by means of the flat circular limb D, and the stop or check upon it *d*.

Figs. 1 and 2, E E are two stationary semicircular cast-iron beds, exactly corresponding to each other in every particular, and permanently fixed in exactly corresponding situations into two pieces of portland stone *e e*, by means of two jagged irons, projecting behind each bed. It is into these beds that the instrument is occasionally placed when carried from one stone to the other, and is rendered firm and permanent therein, by means of a springed catch *f f*, plate XXXIII, fig. 3, protruding in the inside of a central hole in each bed, which seizes the axis *e*, plate XXXIII, fig. 3, of the instrument when placed into the holes; and there is a button attached to the lower extremity of each spring catch which must be pulled down to extricate the instrument when required to be removed, seen at F F, plate XXXII, figs. 1, 2. The instrument is also prevented from turning upon its axis G G by the addition of two small cylindrical studs *g g*, plate XXXIII, fig. 4, projecting at the hinder and upper extremity of the sustaining ferrule H plate XXXII, fig. 2, and which insert themselves into two of the cylindrical holes I I, figs. 1 and 2, surrounding the front extremity of each bed: by means of these small cylindrical studs, the central axis G, and the strong spring catch *f f*, plate XXXIII, fig. 3, the long cylinder or body of the instrument is rendered firm and permanent in any direction in which it may be placed, whether perpendicular, horizontal, or otherwise.

Plate XXXII, figs. 1 and 2, II the cylindrical holes by which the instrument is placed in the same position when removed from one bed to the other.

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H a cylindrical ferrule, slit at both extremities, which surrounds and sustains the large cylindrical tube B, and to which are attached the central axis seen at *e*, plate XXXIII, fig. 3, and the two small cylindrical studs *g g*, plate XXXIII, fig. 4.

Plate XXXII, fig. 2, B the long cylindrical tube, which sustains, elevates, and lowers the upper parts of the instrument by sliding through the cylindrical ferrule H, which ferrule has the power of binding the tube fast therein by the screws *h h*. This tube also gives to the instrument, by means of its axis at G, and the holes surrounding the front of the beds, seventeen different positions, in the arc of a semicircle.

And in *pointing* colossal statues or groups, the same cast iron beds are made permanent upon the center and front of the original model and marble intended for the group or statue, instead of being fixed into the beforementioned Portland stones *e e*, Plate XXXII, figs. 1, 2, which in this case is dispensed with altogether. This tube will give the instrument (by reversing it in the ferrule H) the same number of motions or positions downwards; thus giving to the principal body of the instrument 32 different directions in a whole circle, which, with the addition of those situations that may be obtained by the other parts of the instrument, make the positions of the needle point innumerable.

Thus when all the *points* are gained upon the upper parts of the statue or group, the lower *points* can be obtained by reversing the greater cylindrical tube downwards in its ferrule.

In executing a large bas-relief the same method used in the colossal statues or groups may be adopted by fixing the beds in the center, thereby excluding the necessity of bed stones. The tube B, plate XXXIII, fig. 2, being 3 feet long, with the assistance of

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the lesser tube 2 feet long upon the circular limb, would *point* a bas-relief 10 feet in diameter, and by the addition of 3 feet more of tube being screwed to the lower extremity of the tube B, a greater sweep in circumference could be obtained, containing a diameter of 16 feet, to which distance the needle point can be *mathematically* and *firmly carried.*

The upper extremity M of the cylindrical tube B has a cylindrical cavity, into which a cylindrical stem fits, thereby giving a rotatory motion to the circular limb and lesser cylindrical tube C, by which, together with the oblique motions or directions of the greater cylindrical tube B, the sculptor is enabled to take his *points* with the needle perpendicular or in any direction to a plane behind the model or marble, a very desirable advantage to sculptors.

The rotatory motion at M, is stopped by the screw *m.*

D, Plate XXXII, fig. 2, a circular limb by which the lesser cylindrical tube C may be adjusted upon its axis *d* to any position or angle downwards or upwards within 180 degrees from the greater cylindrical tube B; it is stopped in the different positions by screwing the check *d* (which slides upon the circular limb), close against the fulcrum of its axis *D.* Its principal use, is, that the tube C, containing the needle point, may be turned up out of the way, and returned again at pleasure to the same position, always found by the check *d.*

N the lesser cylindrical ferrule, attached to the circular limb D, and surrounding the lesser cylindrical tube C.

C the lesser cylindrical tube, which slides through the cylindrical ferrule N, and is bound tight in its situations by the screw *n* of the ferrule: its use is, to carry the needle point to the different parts of the front, sides or back of the model and marble, and by means of the circular limb to turn it off.

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O *o* the ball and socket, screwed firmly at right angles into a cylindrical cavity, at the extremity of the lesser cylindrical tube C; this gives the needle containing the point a complete rotatory motion in every angle under 90 degrees.

The motion of the ball and socket is prevented by turning the screw *x*.

P a triangular bar containing the needle point, which bar slides through a triangular socket Q, attached at right angles to a stem inserted into the ball *o*; this triangular socket contains a spring, which keeps the triangular bar or needle moderately tight, to prevent it from dropping out.

p a stop or check upon the needle, by which the distance of the *point* is defined, and at the same time admits of the needle or bar being drawn back out of the way of the superfluous marble, until it be sufficiently reduced to admit of the needle point R to extend to the distance allowed by the check *p*, being the precise *point* or distance upon the original model obtained upon the marble, which is the object of this instrument.

Plate XXXIII, fig. 1, a front view of one of the cast iron beds which is made to an exact and equal size and thickness. *a* a semicircular groove which is sunk round the face of the bed, and comes exactly behind the cylindrical holes, seen at I I Plate XXXII, figs. 1 and 2, in the gun metal plates which are screwed, as facings upon the front surface of the cast iron beds; this groove communicating with all the cylindrical holes, is made for the purpose of carrying off any dust that may accidentally lodge in them. *b* a projection which extends to the outward surface of the gun-metal facing plates; a similar projection also extends behind, both of which are seen in the view at fig. 2, *b c*, and the use of which is to lengthen the central hole *d* (fig. 1) that the axis *e* (fig. 3), of the instrument may work the more steadily; at the same time the projection *b* (figs. 1 and 2), likewise serves

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as a central guide to the gun-metal facing plate; these plates must be screwed exactly in the same position and situation upon each bed; and must be bored together in the lathe, so that they may exactly accord with each other in every particular, as it is upon the exact equality of these plates and cast iron beds, that the mathematical correctness of the instrument chiefly depends. The central hole *d* (fig. 1) is made a little conical; also in the center of it at *d* rises a steel catch, forced up about a quarter of an inch by a strong helical spring *q* (fig. 3); this catch is about $\frac{1}{4}$ of an inch in diameter, being a cylindrical bar of steel, having a hollow chamfer at the upper extremity *f* (fig. 3), that the axis of the instrument when placed into the hole *d*, might press it down and lock itself freely, by admitting the catch to rise again into an angular groove, which is made round the middle of the axis *e*, fig. 3.

At the lower extremity *i* (fig. 3) of the cylindrical hole for admitting the catch, is screwed and sunk into the level of the cast iron, a small circular brass plate *j*, having a square hole in the center of it, through which the catch moves to prevent it from turning round; this plate likewise serves as a shoulder to the helical spring, which forces up the catch.

k k, fig. 1 are two cylindrical holes admitting cylinders, which are turned upon the extremities of the jagged irons *n n*, fig. 2. These irons are made fast to the back of the bed by means of female brass nuts *o o*, which screw upon male screws formed upon the cylindrical extremities of the jagged irons; these nuts are sunk into recesses, so as to be even with the surface of the cast iron bed.

In order to fix correctly the beds *e e*, plate XXXII figs. 1 and 2, to the stones, the jagged irons *N N* must remain screwed fast in the beds, as in fig. 2, plate XXXIII, whilst they are inserting into the stones, which is done with fused lead.

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In case the instrument should require to be placed behind an intricate group or statue, where an impossibility existed of obtaining the *points* otherwise, the beds may be removed behind with very little trouble, by unscrewing the gun-metal facing plates, and the four female nuts which fasten the beds to the jagged irons already fixed into the stones; then with the addition of four other jagged irons let into the opposite side of the stones in the same manner as the others, in equal positions, the sculptor has the advantage of using his instrument both at the back or front of his group or statue. It is necessary to observe that the back and front of the stones must be *parallel* to each other, and of the same distance across, if the beds be removed behind.

Fig. 3 is a section of one of the cast iron beds, and of the ferrule which sustains the large cylindrical tube B, fig. 5. It likewise shows the axis attached to the ferrule which is made a little conical to fit the central hole *d*, fig. 1.

Fig. 4 is an upper end view of the ferrule H, (fig. 3) which shows the brass or gun metal piece, which is attached to the hinder extremity of the ferrule, and into which the two cylindrical studs *g g* (fig. 4) are screwed, which fit exactly into two of the cylindrical holes at I I, plate XXXII, figs. 1 and 2. For giving positions to the large cylinder B, plate XXXIII, fig. 5, or plate XXXII, fig. 2.—Fig. 4, *h* shows one of the screws which have been noticed at *h h*, plate XXXII, fig. 2, and which bind the slit extremities of the ferrule H, upon the cylinder B. It must be observed that both of the cylindrical ferrules are lined with woollen cloth at the extremities: *l l* the thickness of the gun-metal facing plate, at the upper extremity of which is seen a projection *m* belonging to the same plate, which forms a semicircular covering S, plate XXXII, figs. 1 and 2, to protect from dust the holes, &c. in front of the beds.

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Fig. 6, pl. XXXIII, shows a part of the instrument which sustains the flat circular limb D, shown separately at fig. 10. *Q* (figs. 6 and 9) shows the cylinder which has a rotatory motion in the cylindrical cavity *r r*, figs. 5 and 7. *s* (fig. 6) is a part above the cylinder *Q*, which supports the axis of the circular limb, and contains an oblong square hole *t*, which admits the circular limb D (figs. 8 and 10) in order to steady it. The sides of this hole are lined with steel plates, one of which is seen at *W* (fig. 9) for the better working of the circular limb through it. It is against this hole that the stop or check *d* (fig. 10) occasionally stops the progress of the limb, in order to give any required position, upwards or downwards, to the lesser tube C, fig. 13. *u u* (fig. 8) shows the portion *s Q* of fig. 6, which is made into two parts, in order to admit of the circular limb within the oblong square hole *t*, fig. 6. *V V* the screws to close them. *x* the milled head of a small cylindrical axis which passes through three cylindrical holes at *y y y*, forming an axis to the circular limb D, figs. 8 and 10. The motion of the limb is rendered tighter or freeer by means of the female nut *z* (fig. 8), which is screwed upon the other extremity *i* of the cylindrical axis *x* (having a male screw upon it) forming equal sides, 2 2, fig. 6, and pressing equally upon each side of the fulcrum and limb. 3, 3 (figs. 6 and 8) are two pieces which are screwed upon each side of the center piece of the circular limb, and surround the upper cylindrical tube C (fig. 13). These pieces strengthen the ferrule and circular limb upon its axis, and by means of the screw *n* (fig. 6) binds, in any required position, the tube C, fig. 13, *d* (fig. 10) a check or stop upon the circular limb, of which figs. 11 and 12 are a front and end view. It requires the two screws 4, 4 for the convenience of tightening the check on whatever side may be opposed to the hand. In the inside of this check are two thin plates of steel, which

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are pressed against the flat sides of the circular limb by the screws when tightened.

Fig. 14 represents the steel ball and brass socket with the needle; with the manner of attaching it to the extremity of the tube C, fig. 13.

Fig. 15 shows the section of the socket with the ball in it. 5 the cup, which is slightly pressed up against the under part of the ball by the small brass helical spring 6, thereby keeping the needle or triangular bar P (fig. 19) from falling from one side to the other, when the pressure of the screw 7 is taken off in order to move the ball. 8 a piece screwed permanently into the lower part of the socket at 9, through the center of which a small cylindrical screw 7 passing up the center of the helical spring, acts powerfully upon the cup and ball 5. The introduction of the piece 8 admits of the screw 7 to be very small in diameter, which greatly increases the leverage power of its milled head. 10 shows the form of the steel stem which is screwed into the ball, and also of the triangular socket attached to it, which sustains the triangular needle or bar. Inside of the triangular socket a brass spring 11 is screwed, which presses at each end of it upon the whole breadth of the under side of the triangular needle.

Fig. 16 an end view of fig. 15 put together.

Figs. 17 and 18 are an end and side view of the check or stop 12 (fig. 19) upon the triangular needle or bar; this has also in the inside a plate of brass, which is pressed upon one side of the needle or bar by the screw 13.

Fig. 20 the needle point, made of brass, to prevent its injuring the marble by rust, which is screwed into the end of the triangular bar.

The principal advantages of this instrument consist in its motions and positions being guided and kept firm by

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powers of its own, and depending very little upon the judgment or care of the sculptor in the application of it, he having merely to stretch the needle point to the intended part upon the model, and to move and screw the check upon the circular limb and triangular needle, and to tighten the screw of the rotatory motion under the circular limb; and, lastly, to transfer the instrument to the bed of the marble. The other screws or motions are only used to fix a position or positions of the instrument for taking *points* upon the sides, back, or any particular mass in front of the model, containing many *points* which require not the major parts of the instrument to be removed until this mass of *points* be finished.

It must be particularly observed that, by the addition of three or four checks or stops upon the circular limb and triangular bar or needle, three or four *points* may be taken at once before the instrument is removed from the original model to the marble. However, the facility of transferring the instrument is such as to supersede the advantage of taking many points at a time.

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PAPERS

IN

COLONIES AND TRADE.

N° I.

CURING BRITISH HERRINGS.

The Sum of FIFTY GUINEAS *has been voted this Session to Mr.* J. F. DENOVAN, *of Leith, for Improvements in the* CURING OF BRITISH HERRINGS, *and for his strenuous endeavours to bring them into successful competition in the Hamburgh market, with the best Dutch Herrings.—The following communications have been received from him on the subject.*

Leith,
October 31, 1818.

SIR;

I BEG leave, respectfully, to acquaint you, that I have shipped by the smack Hope, Francis Ord master, for London, a sixteen gallon barrel of white herrings, cured by me in the manner of the Dutch, addressed to William Vaughan, esq., Mincing-lane, London, in order to be laid

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before the Society of Arts, &c. The herrings contained in this cask, are a mixture of those cured by me on the west and east coast of Scotland, in the prosecution of a plan to compete with the Dutch in the continental markets.

It is now four years since I planned and entered on this undertaking; and, although the scale is limited, I flatter myself, that the execution has at least kept pace with the design. Having acquired a thorough knowledge of the Dutch language, during a residence in that country in the early part of my youth, I returned to Holland about four years ago, for the express purpose of collecting from all available sources of information, such particulars as might enable me to carry through my undertaking with success. The year after my return, I made it my business to visit the different fishing stations in Scotland, and to be merely an observer of the different modes of cure practised by my countrymen. Wherever I went, I was sorry to find the most eminent and experienced fish curers, not only deaf to my remonstrances on their method of putting up herrings, but strongly prejudiced in favour of their own system; and that they invariably used Liverpool salt at all times, and for every species of herrings they cured, which were thrown together indiscriminately. The year following (1817) having provided myself with a complete stock of Lisbon, Cadiz, and St. Ubes salt, and having brought from Maas Sluis (in Holland), six of the most experienced gutters and packers of that country, I proceeded to the West Highlands of Scotland, with the intention of curing a quantity of the early herrings of Lochfine, and exporting them to Hamburgh, in competition with the Dutch jagers; but owing to the Dutchmen I had engaged being retarded in their passage to this country, my design was frustrated, and the Dutch herrings reached that market

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before me. However, it was admitted by the most experienced dealers in Hamburgh, when my shipment arrived, consisting of forty barrels, that they were not only as well cured as the Dutch, but that the fish were, in themselves, of superior quality. Knowing, from observation and experience, that the herrings which frequent the Bay betwixt Dunbar and Eyemouth in the month of August, are of the species best suited for later importation to the German market, I carried my Dutchmen to Eyemouth, and cured openly for the instruction of those who chose to avail themselves of it, about 300 barrels exactly in the Dutch mode, which I afterwards exported to Hamburgh. These herrings were sold at a price, which would have yielded me a decent profit, but unfortunately the House of Daniel Lane, junr. and Co. to whom my herrings were consigned, suspended payment, and to this moment I have not received a single sixpence in return, although it may well be conceived that as my operations were attended with extra outgoings and expenses, my loss must have been considerable.

Although my circumstances could ill admit of such a blow, I was determined to make another effort; and by perseverance and exertion, try to recover the loss I had suffered: accordingly in the month of May last, I again brought over four gutters and packers from Maas Sluis; and having procured a vessel of about 70 tons burthen, and provided her with every necessary, I proceeded to Lochfine, which I reached on the 27th of that month. In order to ensure success, I engaged, and gave a bounty of twenty guineas, to one of the most expert fishers and experienced pilots of Newhaven (Wm. Main), not only to pilot the vessel to the different heads and bays, betwixt Tarbet and the Isle of Arran, but to endeavour to stimulate the highlanders to follow his example, by casting his nets

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before them along the coast. I, also sent notices to the different highland villages, that bounties would be given to those who caught the first sound herrings; and urged them to action, by distributing oatmeal and other provisions to their families; and, I invited them to send their boys on board, to learn the Dutch method of gutting and packing the herrings.

My expectations were so far answered, that, on the 4th of June, I obtained four barrels of herrings; and, although the great proportion was of the Maatje species, still there was among them a considerable number of full herrings of excellent quality; of these, when carefully assorted, I sent to London a quarter barrel, which was presented to his Royal Highness the Prince Regent; and it was certainly very gratifying to me, to be informed, that his Royal Highness considered the herrings to be the finest he had ever eaten; while Sir Benjamin Bloomfield gave it as his opinion, that they were superior to those he had tasted in Holland. It has long been a custom with the Hollanders, to send the first barrel of herrings taken at sea to their Stadtholder; and the fortunate individual who can do so, receives a premium of a thousand guilders. But such are the defects of the British law, that the fish curer who removes, or exports his herrings without allowing them to lie fifteen days in salt, to entitle them to be branded by the fishery officer, forfeits the usual bounty of four shillings per barrel! Thus, instead of any inducement being held out by government to individuals to compete with the Dutch in the continental market, they are absolutely discouraged from doing so; and, although I out-stripped the Dutch with a fleet of 278 Doggers, and supplied the table of my Prince with the *first herrings taken on the British Coast*, previous to the King of the Netherlands receiving his compliment, what has been my recompense?

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I do not mean that this should be regarded as a reflection on the legislature, but as a defect and grievance which, through such a channel as the Society, may meet redress. For I flatter myself, that were it represented in the proper quarter, this glaring error would immediately be corrected, so as to put the British fishermen on an equal footing with those of Holland.

After sending off the quarter barrel of Herrings to London, I engaged a fast sailing schooner, called the Two Sisters, Komeyer master, which was then lying in Leith harbour, to act as a Jager: I sent her through the canal to Greenock, to receive and run to Hamburgh, with fifty barrels of my herrings so soon as they could be cured and shipped on board her; and I flattered myself, from the arrangements I had made, that I should not only have the first herrings in the German market, but that the herrings I imported would be of a superior quality to those of Holland. In this, however, I was grievously disappointed, for owing to the breaking down of one of the banks betwixt Kelvin and Greenock, the canal was in consequence shut; and my vessel, with the fifty barrels of herrings on board, unfortunately locked in for twelve days! After getting her through the canal to the Frith of Forth, she not only met with adverse winds, but was so much becalmed at sea that she made a passage of no less than eleven days to Hamburgh; and the market having in the interval been filled or rather glutted with herrings by the Jagers of Holland, Emden and Altona, my fifty barrels only netted 123*l.*; and as they stood me fully 6*l.* per barrel, my loss was about 200. Intermediately however, and while the schooner was locked up in the canal, I got forward to Leith a few kegs of herrings, which I shipped by the smack Edina, I. I. White, master, to Hamburgh. They arrived *only two days* after the *first Dutch Jager*, and

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sold at the rate of 15*l.* per barrel: had nothing befallen the schooner, and had the fifty barrels reached Hamburgh at the same time as the Edina, I should certainly have realized about 400*l.* sterling; and had the schooner got there before the Dutch Jager, I should have gained 200*l.* or 300*l.* more, for the Dutch got from 20 to 25*l.* sterling per barrel for their herrings, which it is admitted in Hamburgh were of inferior quality to mine. The importation, however, of these kegs, and of the 50 barrels afterwards, has certainly done much for the British fishery, by giving it a character in the German market which it never before possessed.

Although my project at Lochfine had the effect of making the Highland fishermen try the fishing much earlier than usual, it did not operate in my favour in the end; for the proprietors of the *fresh* fish wherries at Glasgow, on hearing that I was successful, immediately dispatched their boats to the fishing ground, and bought up the herrings from the Highlanders to carry to that market, in a fresh state, at such a high price that they were actually retailed in that city at 3*d.* per fish. It was even with difficulty that I could obtain herrings from the boats at the rate of 5*s.*, 6*s.*, 7*s.*, and even 8*s.* per hundred fish. After I had dispatched the schooner with the fifty barrels for Hamburgh, and had cured about twenty barrels to be done up in kegs for the supply of the Edinburgh market, I gave up the attempt, and carried my Dutchmen to Eyemouth as in the preceding year; for even at the lowest rate, say 5*s.* per hundred, I could not, as the season advanced, salt and export these herrings without suffering a loss.

The example I set at Lochfine, however, was not without its advantages: it certainly was the means of employing many idle men, who were on the point of emigrating to America; and by having invited on board the sons of

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the fishermen, and having instructed them carefully in the Dutch mode of gutting and packing, I shall be enabled next year to prosecute my undertaking without the aid of Hollanders.

At Eyemouth the fishing was, in general, but very limited; and owing to the boats at that port having been previously engaged to the curers resident there, I could only procure and salt ninety and an half barrels of prime full herrings for exportation, and fourteen kegs for home consumption and sample. These ninety barrels I sold to a respectable merchant and fish dealer from Hamburgh, at thirty-seven shillings per barrel, being six shillings per barrel above the market. This merchant left Leith some days ago for Hull, otherwise I should have obtained a certificate from him expressive of his opinion as to quality and cure; but I have written to him to send me such a document, and should it arrive in time, it will accompany this letter.

Last year I sent sample kegs of my herrings to several public characters both in Edinburgh and London, to learn their opinions on the mode of cure I had adopted; and I have used the freedom to send up a few of the letters received from these gentlemen, for the perusal of the Society. I regret however that the existence of this very laudable institution only came to my knowledge within the last eight days. Had I known it last year, I would have forwarded samples for inspection. Although I must account myself a stranger to the rules and regulations of the Society, yet aware of the liberality of all English Institutions of that nature, I humbly submit to their consideration a faithful and true sketch of my proceedings, with a sixteen gallon barrel, containing a *just* and *fair* specimen of the herrings cured by me, as well at Lochfine as in the North Sea: they may easily be distinguished from one another by the manner in which they are gutted. The

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North Sea herrings have the gut hanging out in the manner of the Dutch, which has the effect of enriching the pickle; while those of Lochfine are *clean gutted*, a measure absolutely necessary for their *perfect* preservation; for the quantity of fixed oil which proceeds from the gills and gut of the Lochfine herrings in the early part of the season, is so great, that it would, by allowing the gut to remain, tarnish the scales, and to use the curer's phrase, *gild* the herrings.

The herrings contained in the sixteen gallon barrel are cured in the manner described in my certificate; and any further information which the Society may wish to procure in regard to the white herring fishery, I will communicate with pleasure, by way of question and answer.

For the last two years I have been in correspondence with the British White Herring Fishery Board, at Edinburgh, to whose inspection I submitted several specimens of my herrings; and I also corresponded with the commissioners individually, as will appear from their letters herewith sent. As these gentlemen are perfectly aware of the exertions I have used and the money I have expended in the attempt, I supplicated their interference with government in my behalf, to get some assistance to enable me to carry through my undertaking; but although these gentlemen declare my herrings to be not only a great improvement on the British mode of cure, to be *most excellent*, and that they heartily *wish* me success in my undertaking, yet they conceive it, as they say, to be entirely out of their line to recommend any fish curer to government. The project I have embarked in may be attended with difficulties and disappointments, but it is evident that perseverance will overcome them; and as it embraces an object of great national importance, I flatter myself if government knew my position, they would assist me; but having no interest at court, I fear the story of a friend-

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less and obscure individual would hardly be noticed; I must therefore proceed with the means I possess: these means are indeed very slender, but still perseverance with due exertion may do great things; and although untoward circumstances have occurred in the way of my undertaking they were such as I could not have foreseen; and if in the succeeding year I am so fortunate as to anticipate the Dutch in the German market, I shall be amply rewarded without the assistance of any one.

It will afford me much pleasure to learn that the specimen of my herrings meets the approval of the Society; and should this laudable institution feel itself warranted in giving me any encouragement, I shall be most grateful for their bounty. At all events, whether the present specimen meets the approval of the Society or not, I hope they will give me leave, when I next summer repeat my offering to the Prince, to send the Society a portion of the first fruits of my labour.

I am, Sir,

A. Aikin, Esq. &c. &c. &c,

Secretary, &c. &c. JAS. FRED. DENOVAN.

Description of the process adopted by J. F. DENOVAN, *in curing Herrings in the manner of the Dutch at Lochfine.*

When the herrings are brought alongside the salting vessel in the fishing boats, they are counted over, and received into a large net bag with an iron hoop and handle five feet long, and conveyed aft in the vessel under an awning to prevent their being tarnished by the sun or showers Four large baskets are then placed to receive

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the different sorts, viz. maatzes, full-sized, prime full herrings, and *spent fish*, *shotten fish*, and *stragglers;* which three last denominations are packed together. The utmost care and attention was paid to the assorting. Two men were employed in packing; and four men, and as many boys as chose to come on board were employed in gutting. The gutters use a small knife with a long sharp point, about two inches long in the blade and four inches in the handle, with a loop-hole through the same to admit the little finger and prevent the blade from cutting the thumb of the left hand, which it is otherwise apt to do. The blade of the knife near the handle is flattened, and a piece of soft leather tied round it to prevent it from hurting the forefinger of the *right hand;* while the forefinger of the *left hand* is covered with a thick leather thimble, to prevent the long point of the knife from running into it. Each gutter has on his right hand an oblong wooden trough, about four feet in length, covered thinly with fine Cadiz salt, into which he throws the herrings (previously assorted) as they are gutted. In gutting, the point of the knife, which is longer than that used by the British, is run through the neck between the gill and the bone; the long small point perforates the bone; it is then drawn back, and by turning the forefinger of the right hand round the head of the herring, and catching the point of the knife, the gills, stomach, and gut are pulled out betwixt the first and second fingers of the right hand. When each gutter has emptied his basket by gutting the herrings and throwing them into the wooden trough, a quantity of fine Cadiz salt is thrown over them, and mixed with his hands to and fro, until the salt has taken due effect, and the herrings will not slide off the hand or the wooden shovel, with which they are also turned over. The packer then begins to pack. First

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an equal quantity of Lisbon and Cadiz salt, with one-third of St. Ubes salt (pounded in a mortar) is strewed equally on the bottom of the barrel; the packer then lays a row of herrings down on their backs, with the head of the one to the tail of the other, which he strews over with salt; the next row is laid across the first, and so on, strewing salt on each until the barrel is filled, when the whole are pressed down with a piece of round wood; four pounds weight of salt are then strewed over the top, and the cask headed up. The packer then marks on the side of the cask the date, and the curer enters the same in his journal. In three days afterwards the barrels are opened, the superfluous pickle poured off and preserved, and the barrel filled up from another *of the same morning curing*. The British statute requires the herrings to lie fifteen days, until they can be branded for bounty; but experience has proved that ten days is perfectly sufficient for priming. The casks are opened at the expiration of the fifteen days, and examined by the officer of the fishery, whose duty it is to see that the casks be properly filled up before branding; but it is to be lamented that the statute leaves it to the discretion of the curer to fill up the barrels with what herrings he thinks proper, and that without discrimination; for it is a fact that will not admit of contradiction, that the British curer knows nothing of assorting herrings, or ever attempts to practise it.

Many of the British curers will not allow their herrings to be pressed down with the round piece of wood I have before mentioned, or to use their own phrase to be "dunted," and the reason is obvious; their herrings are not assorted, consequently those which are very full of milt and row (near spawning) when laid on their backs with small maatzes or spent fish, must yield to the unequal pressure; but when properly assorted, it has the effect of

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causing the fixed oil to come up with the pickle to the top of the barrel, when it can be skimmed off with a tin platter, which has an excellent effect in preserving the fish in a sweet and sound state.

With the superfluous pickle, when freed of oil, I attempted the cure of mackarel, first gutting them, laying them in Cadiz and common pan salt, and pouring the herring pickle over them. I had not, however, an opportunity of trying this experiment to any extent, the season for that fish being nearly over when I reached Eyemouth, but from what I did cure in this way, I am satisfied that it will answer extremely well, and that mackarel cured in that way would find a ready market. In this way the fish are preserved in a soft plump state, and the herring pickle adds to their flavour. Next year I intend to try something in this way, and shall send an essay to the Society.

It is much to be regretted that government do not remove the duty from foreign salt, when it can be imported at a moderate price. For it is a certain fact that all kinds of Liverpool salt are alkaline and bitter, and our herrings can never possess the flavour of Dutch herrings when cured with it. Besides, the Lisbon and Cadiz salt is not only much more perfect from an equal combination of the ingredients with which it is composed, but is a much more powerful antiseptic, and better adapted for preserving herrings in a warm climate.

At Eyemouth exactly the same process was used, with the exception of St. Ubes salt, which is too strong for North Sea herrings; and that, as the fish are much leaner there, the Dutch mode of leaving the long gut hanging out was implicitly followed. The herrings are, however, brought to the shore at Eyemouth, and cured either on the quay or in cellars; I preferred the latter, so as the

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fish might be protected from the sun and rain, both of which never fail to injure the appearance of the herrings in more respects than one.

Leith, 2nd Nov., 1818.

This relates to my affidavit of this date.

JAS. FRED. DENOVAN.

Before me,

GEORGE CANTAIN, J. P.

Hamburgh,
July 30, 1817.

SCHADTLER, Davids, John and Co., merchants of the city of Hamburgh declared upon oath, that the thirty-nine barrels (one barrel having been used to fill up the other) of herrings, which they received by the Waterloo, captain Claussen, and which were consigned to them by Messrs. J. F. and F. G. Denovan of Leith, have been of an equal, if not better quality than the herrings imported a fortnight ago from Holland and Embden, and if these should have arrived before them, should have fetched the price of at least twenty-five pounds sterling per each barrel.

If these herrings had been salted with Lisbon salt, and if the barrels had been made in the same manner as the Dutch, even the herring company here should not then have taken them for Scotch herrings, which are not liked here at all, and always to be got 50 per cent cheaper than Dutch herrings,—which prejudice, however, they hope to do away entirely in future, if the herrings are salted, prepared, &c. in the way above-mentioned.

SCHADTLER, DAVIDS, JOHN and Co.

Sworn before me at Hamburgh, the 29th of July, 1817, ALEXANDER COCKBURN, his majesty's Envoy Extraordinary, in Lower Saxony.

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Hamburgh,
July 27, 1817.

THINKING it my duty to encourage this branch of trade, I have taken *particular pains* to ascertain the facts mentioned in this affidavit, and I now certify to those whom it may concern, that according to the best of my judgment the statement is perfectly correct.

ALEXANDER COCKBURN.
His Majesty's Envoy Extraordinary
in Lower Saxony.

Hamburgh,
July 8, 1818.

AT the request of Mr. Jurgen Bona Meyer, fish curer of this place, we the undersigned sworn brokers, have examined several barrels of Lochfine herrings, landed the day before yesterday per the Edina, J. J. White, master from Leith, and declare them to be of a superior kind of herrings to any hitherto, to the best of our knowledge, imported to our market from great Britain, and which to all probability might have fetched the same high price which were paid this week for the first Dutch, Embden, or Danish herrings in case the Edina had arrived earlier in port; for in our estimation the fish, as well as the mode adopted in curing the same, are such as to entitle said Lochfine herrings to the largest share in the consumption of our neighbouring markets, provided they be shipped rather early in the season to this port.

Coinciding in the facts above related, we bear testimony to the same by means of our signatures.

JOHN PAUL RIP INE.
JOHANN GERHARD MAACK.

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CONCURRING in the foregoing statement, I have to certify that the aforesaid herrings are of Mr. J. Denovan's curing, and I deem it useful to add that said Lochfine herrings would even surpass in quality the Dutch herrings if proper care could be taken to preserve the brightness of the scales.

JURGEN BONA MEYER,
Fish-curer.

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John White, Esq.

A Shoe for an Ox, in use at Christiana, in Norway.

Two Composition Tiles.

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MR. WILLIAMSON.

Specimens of Engravings of Bank Notes.

The use of Engraved Steel Plates, for the prevention of Forgery of Bank Notes, for a sufficient number of impressions to be annexed to the Evidence in Report.

MR. JONATHAN WILSON.

A bronze Medal of the late Wm. Pitt, Esq.

1818

MR. W. NEWTON.

A pair of improved Pocket Globes.

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Mr Beckway's machine for weighing & binding Hay.

Pl. 1.

Fig. 3.

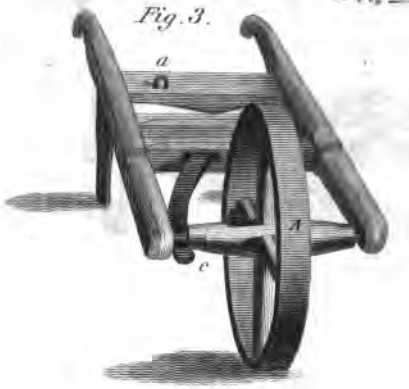


Fig. 4.

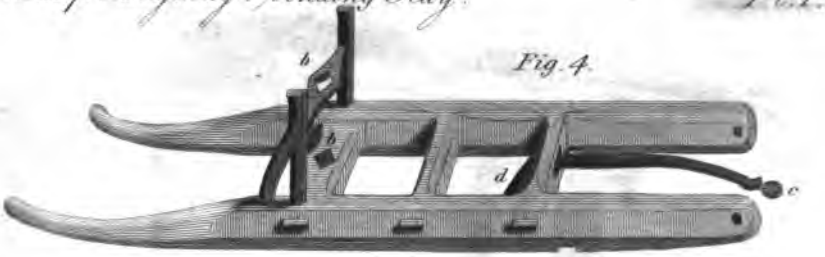
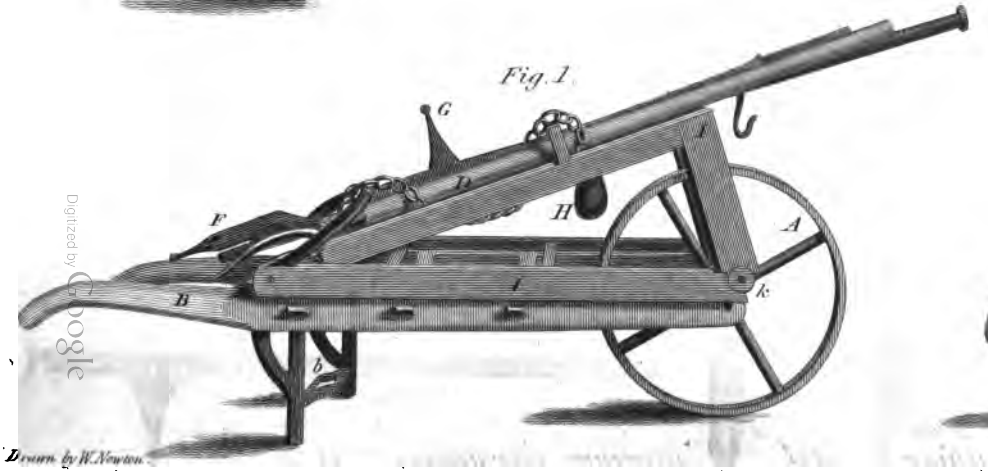


Fig. 1.



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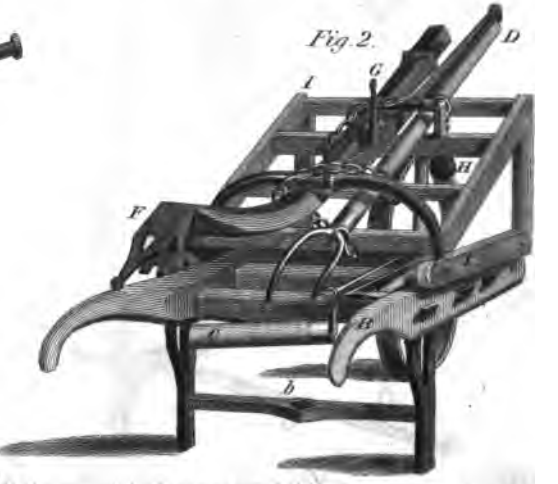


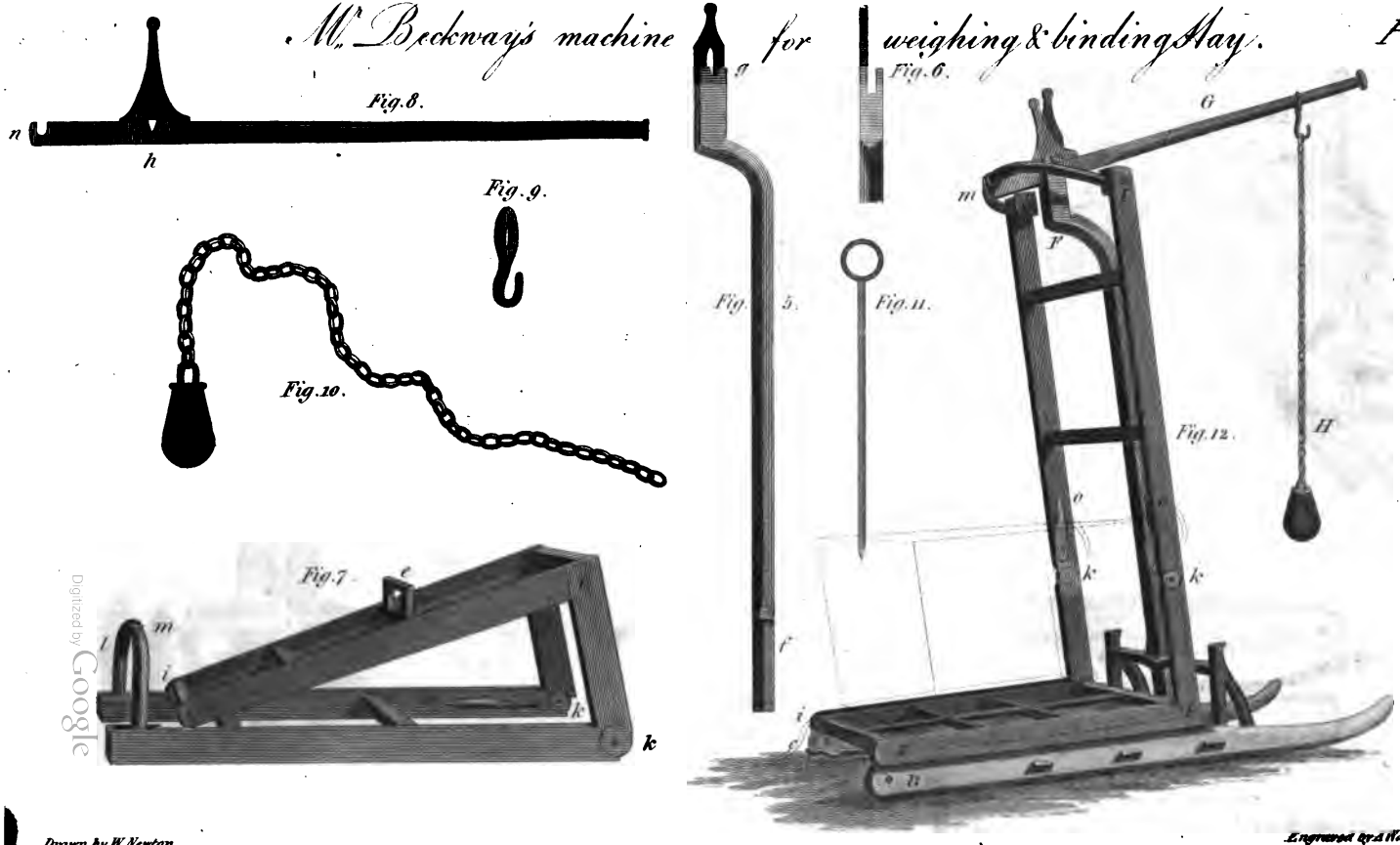
Drawn by W. Newton.

Engraved by A.W. Warren.

Digitized by Google

Mr. Beckway's machine for weighing & binding Hay.

Pl. 2.



Drawn by W. Newton.

Engraved by J. Warren.

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Pl. 3.

Mr. W. Lanes fruitgatherer

Fig. 1.

Fig. 2.

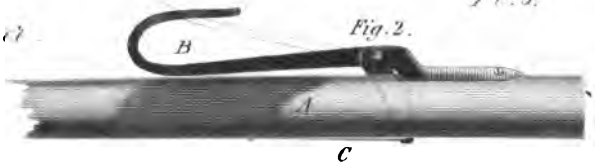

Fig. 3.

Fig. 4.

Fig. 5.

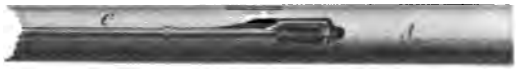

Fig. 8.

Fig. 10.

Fig. 7.

Fig. 6.

Drawn by W. Newton.

Engraved by A. H. Warren

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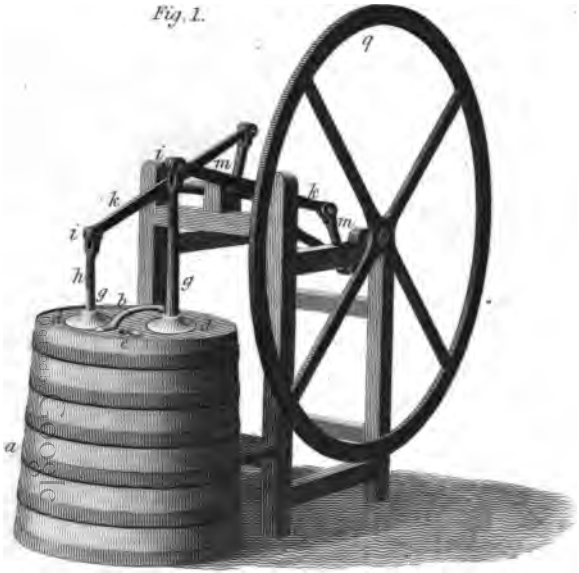
Mr. Roberts's Churn

Pl. 4.

Fig. 1.



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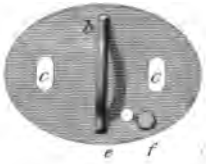

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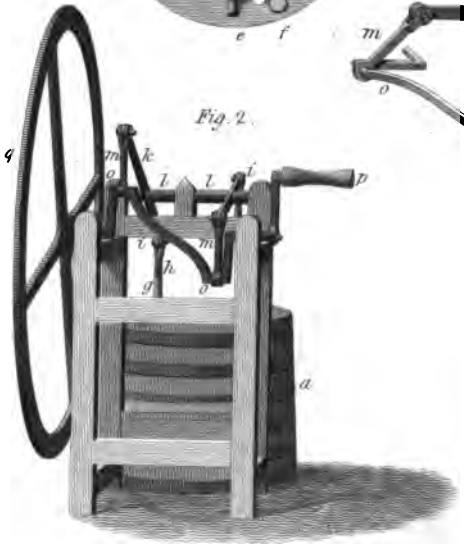
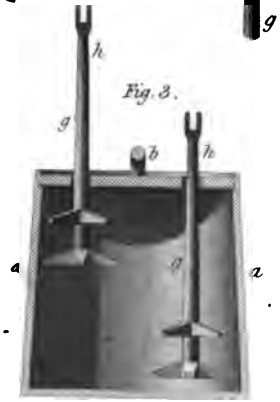


Fig. 5.

Fig. 3.



Drawn by W. Newton.

Engraved by J. B. Taylor.

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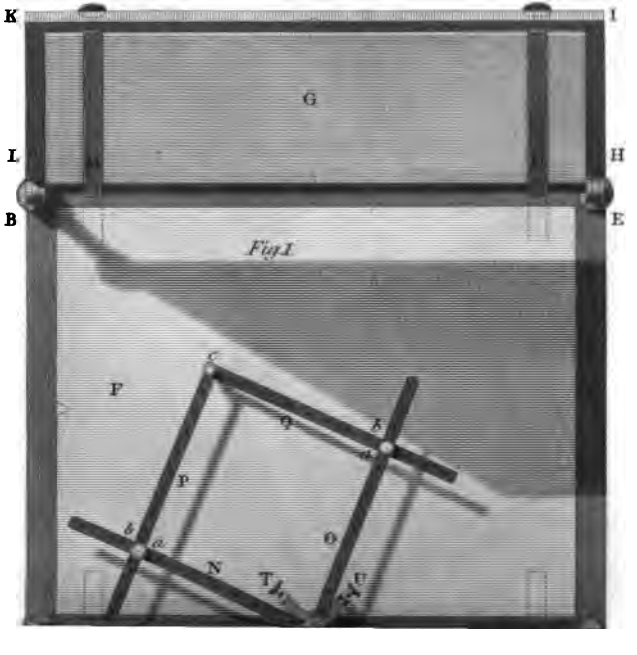
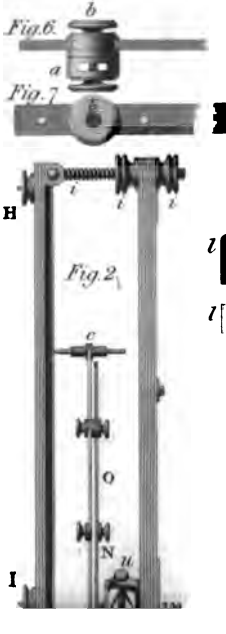
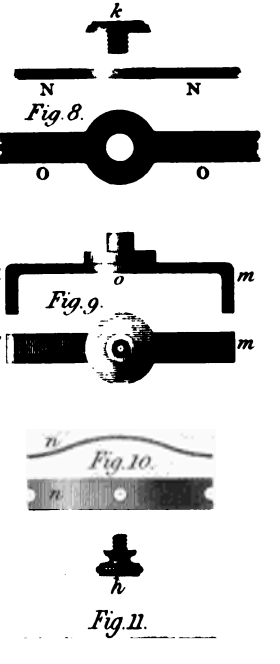
Digitized by Google

Mr. Napier's tracing machine.

Pl. 5.







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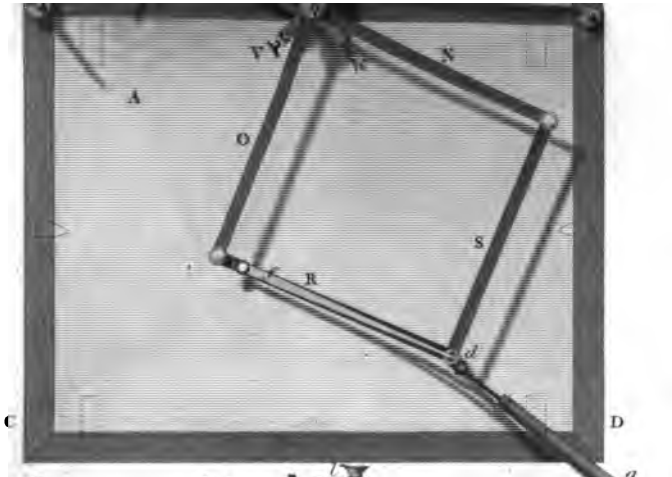
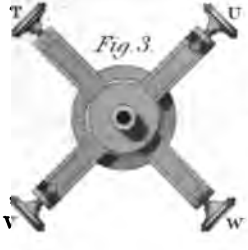
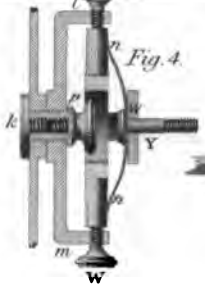
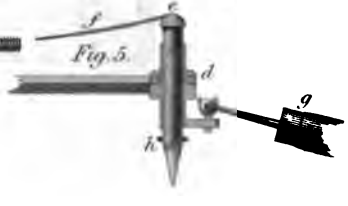
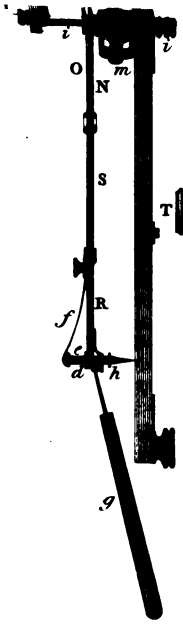


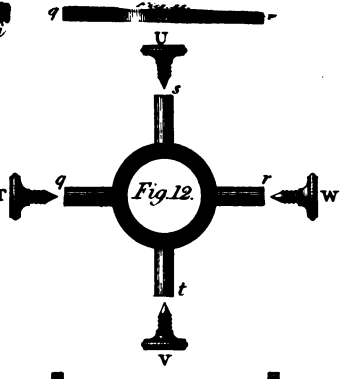


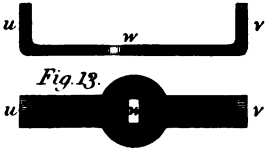


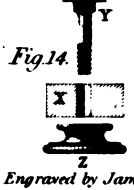


Drawn by Joseph Clement.









Engraved by James Davis.

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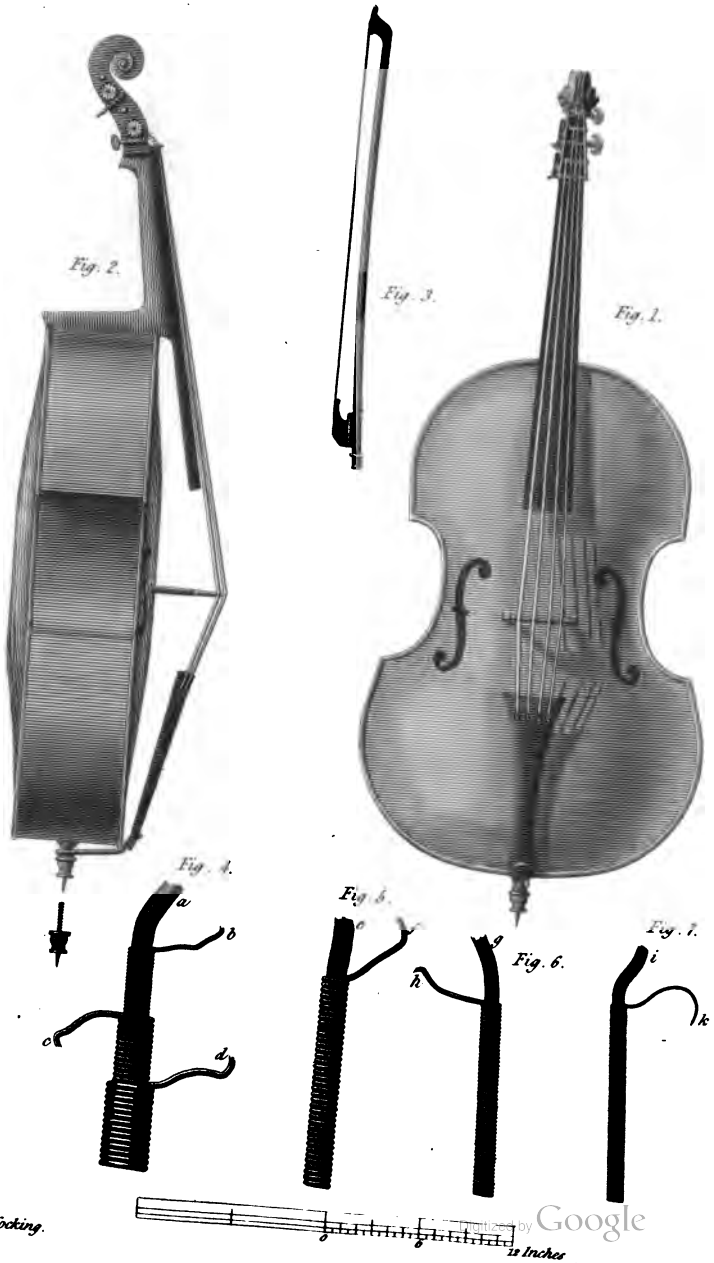
Mr. J. Barraud's Violoncello — Pl. c



Drawn by R. Cocking.

Engraved by G. [illegible]

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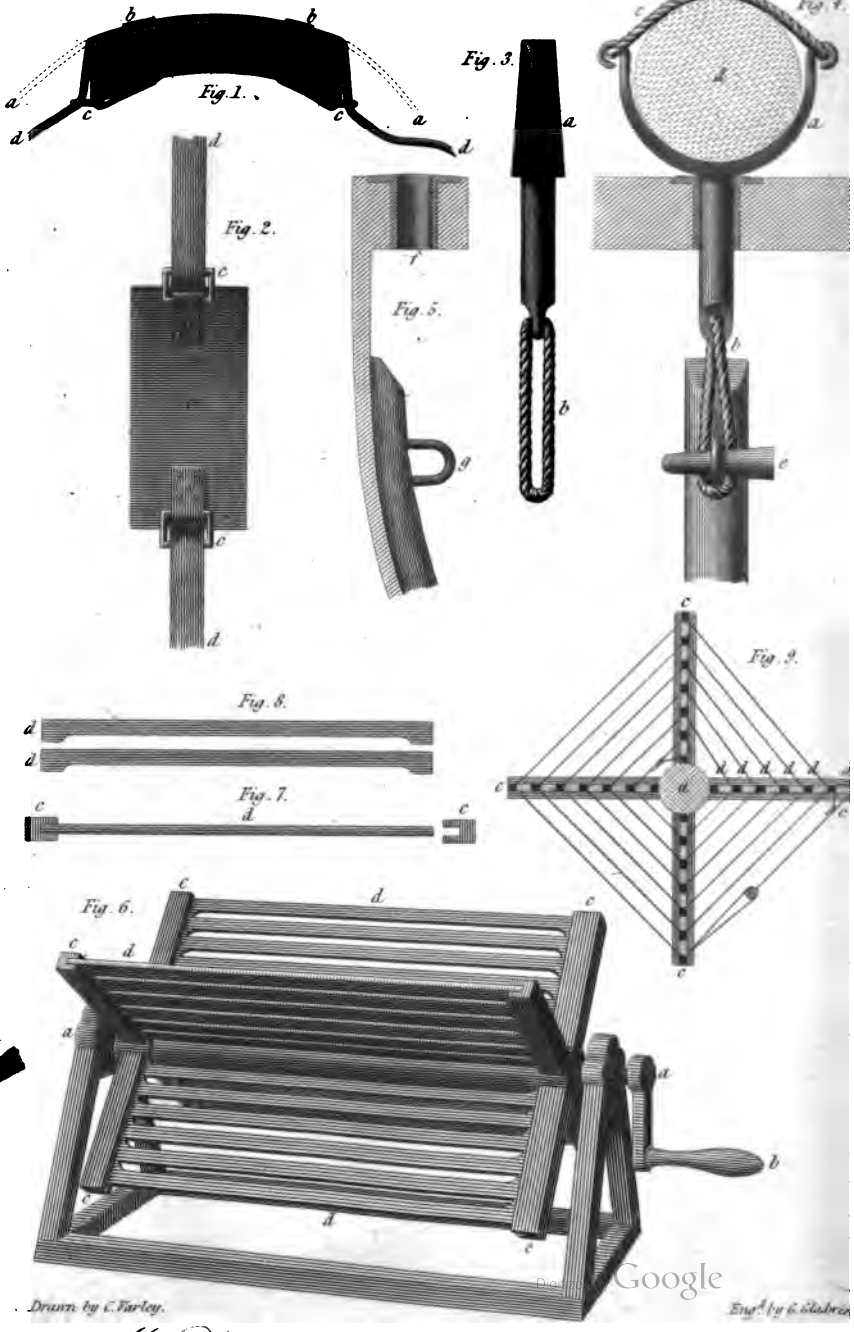
Capt.n Bagnold's Marine Cartouch Box.

Mr Brabrzens Row lock.



Mr Rhodes's machine for drawing woollen warps

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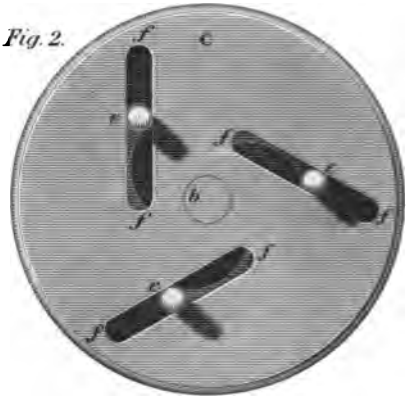
Mr. A. Bell's Chuck for Turners.

Pl. 8

Fig. 2.



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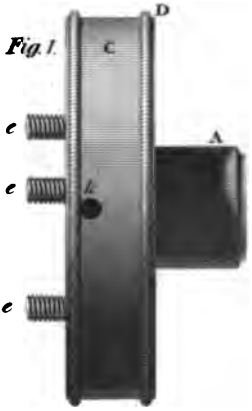

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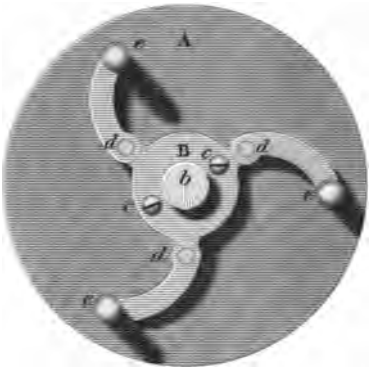
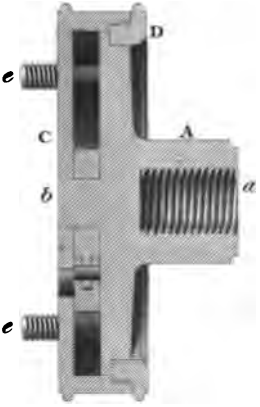


Fig. 3.



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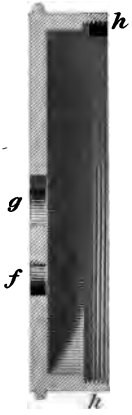

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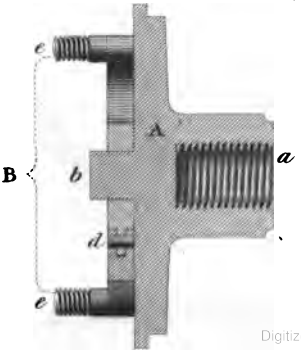

Fig. 7.

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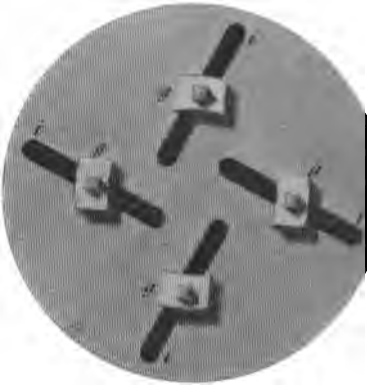
Mr. T. Hack's Chuck for Turners.

Fig. 1.

Fig. 2.



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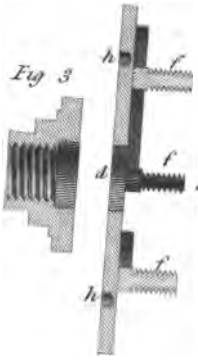

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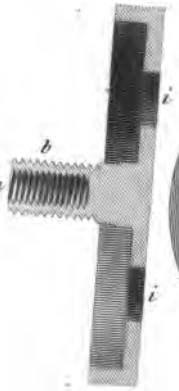

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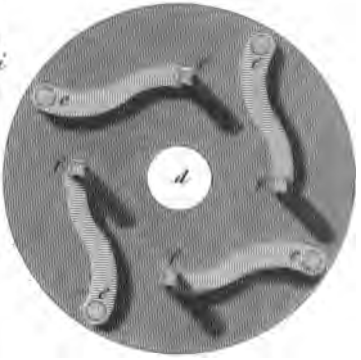

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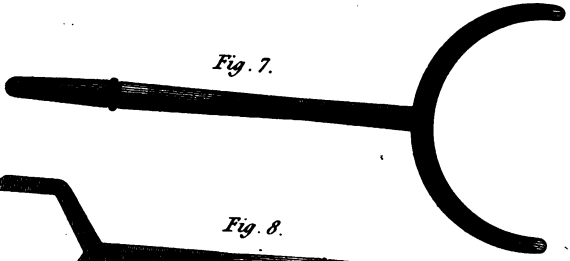

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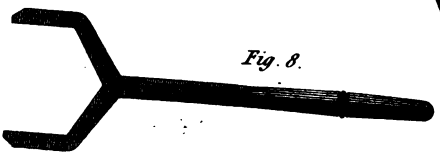

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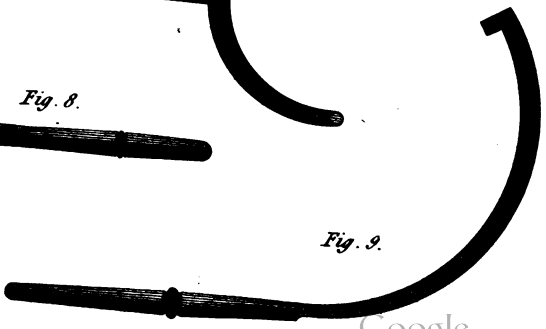


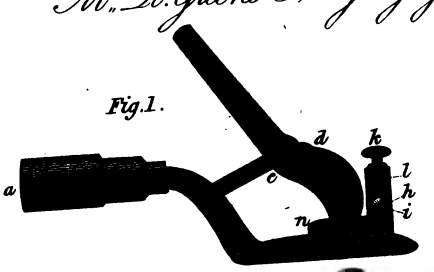
Drawn by J. Clement.

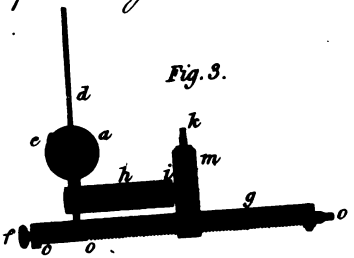
Digitized by Google

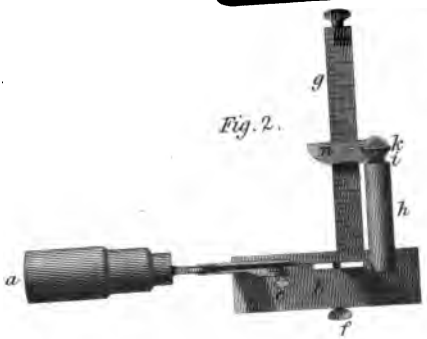
Engraved by Edmd. Turrell.

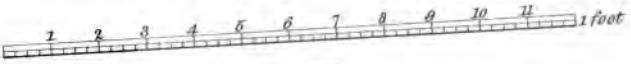
Digitized by Google

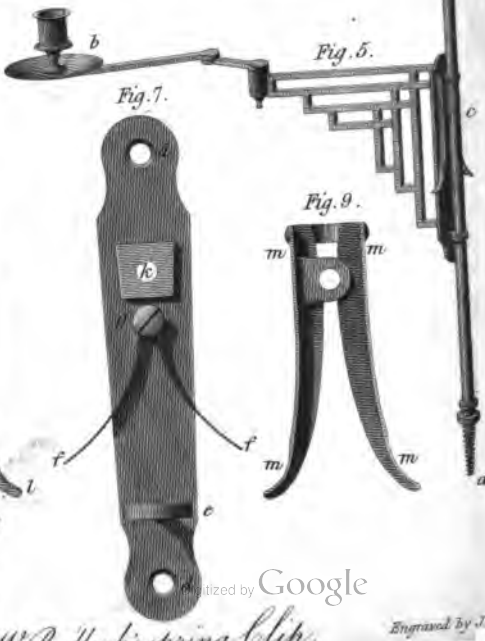
Mr. R. Green's Plough-gage for cutting leather. Pl. 10.











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Mr. W. Bullock's spring Clip.

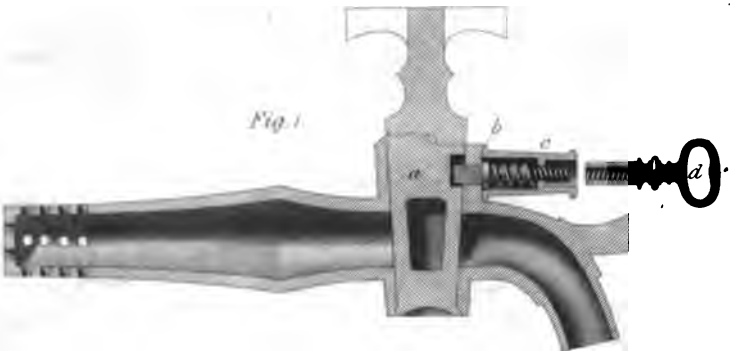
Drawn by H. Gocking. Engraved by J. E.

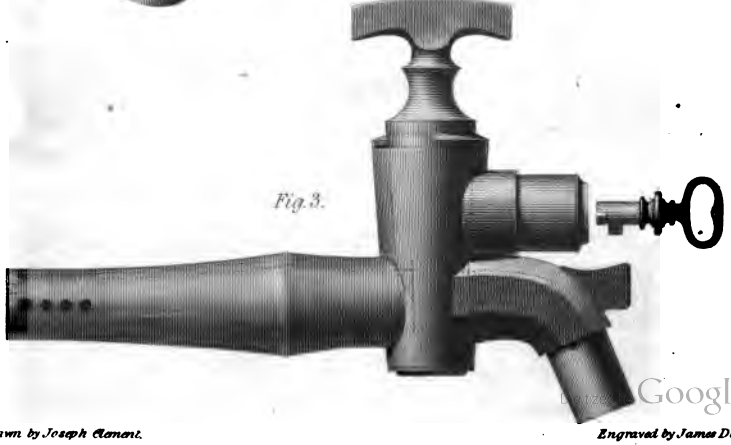
Digitized by Google

Digitized by Google

Mr. W. Russell's Lock for Liquor-cocks.

Pl. II.

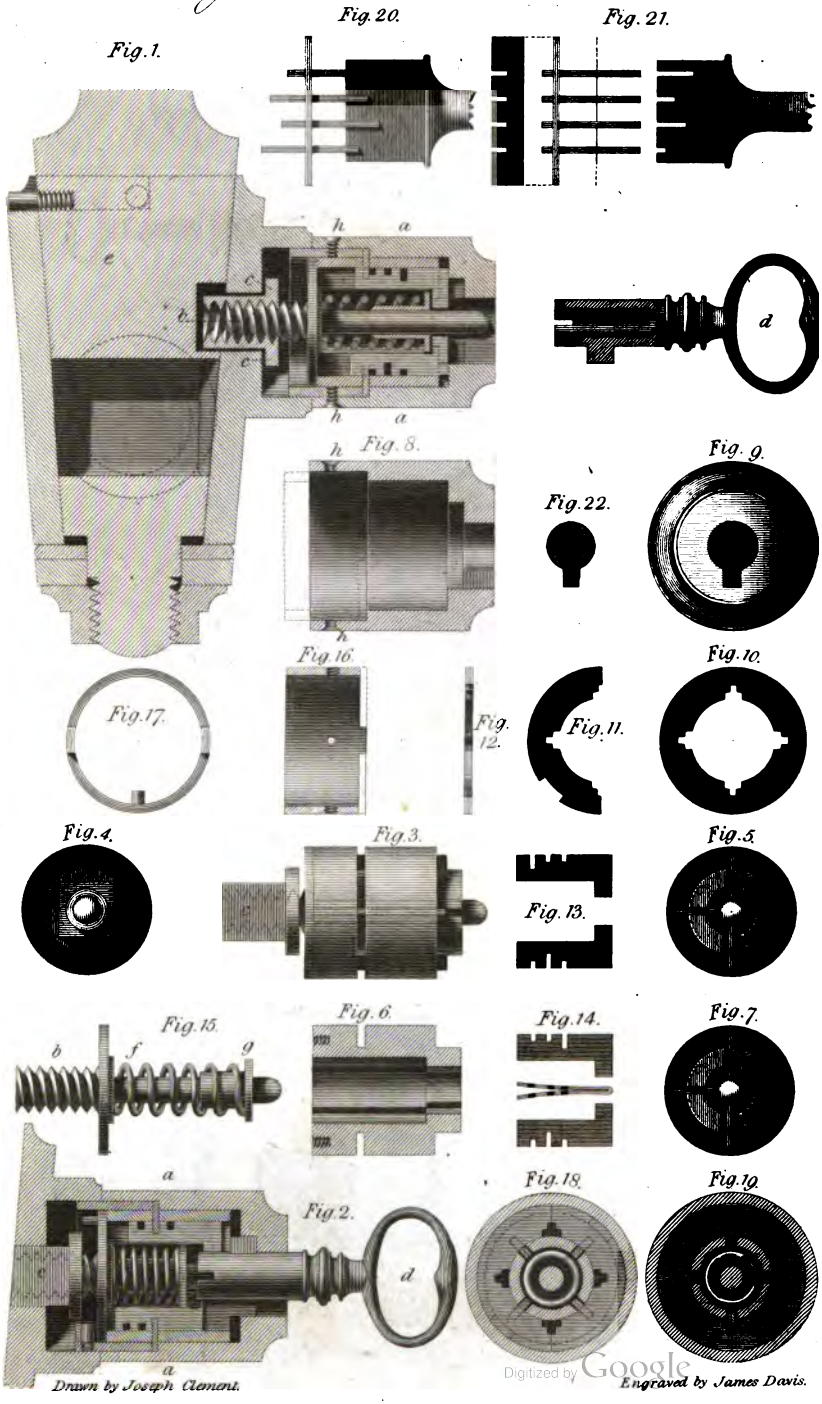




Google

Drawn by Joseph Clement. Engraved by James Davis.

Mr. W. Russell's Lock for Liquor-cocks. — Pl. 12



Drawn by Joseph Clement.

Engraved by James Davis.

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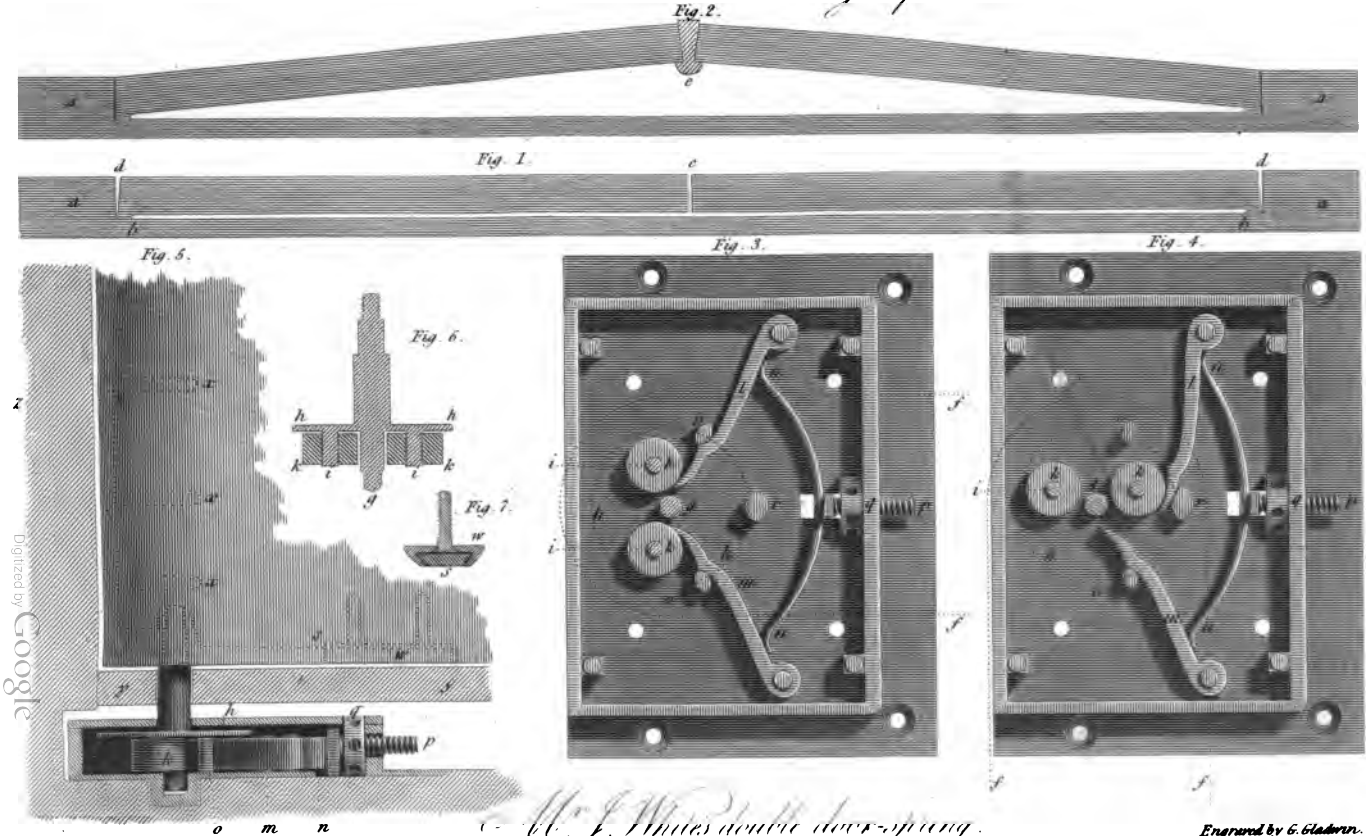
Mr. G. Smart's bow & string rafter.

Pl. 13.



Mr. J. Wiles's double door-spring.

Drawn by C. Varley

Engraved by G. Gladwin.

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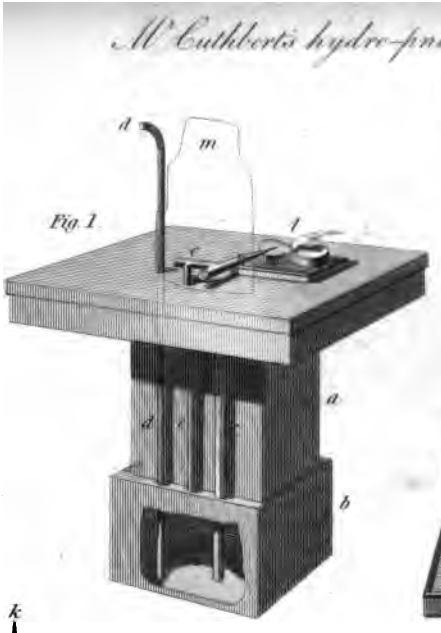
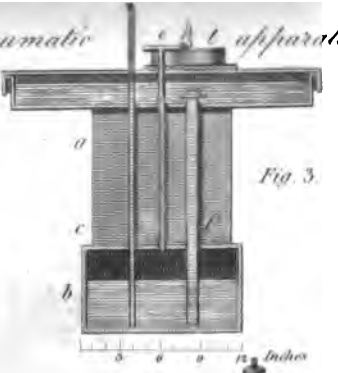
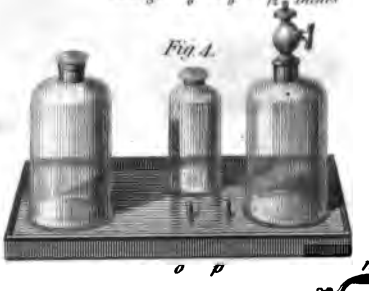
Digitized by Google

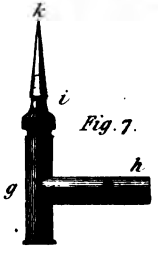
Digitized by Google

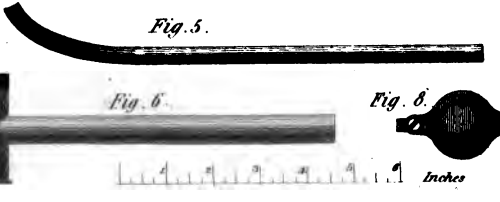
Mr Cuthbert's hydro-pneumatic apparatus.

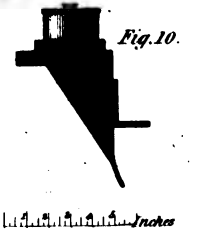












Drawn by R. Cocking.

Engraved by A.W. Warren.

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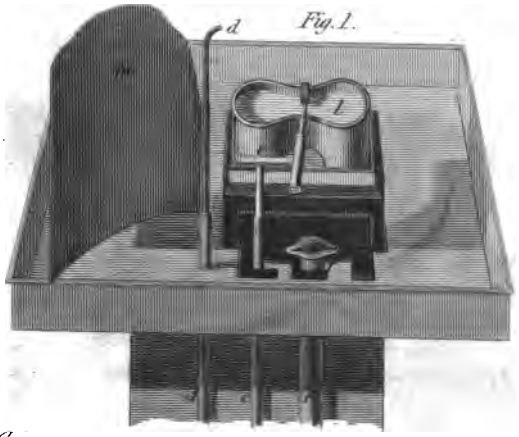
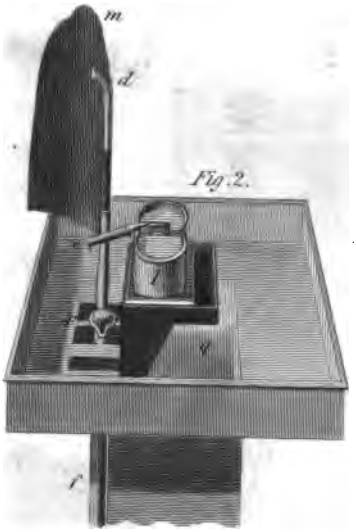
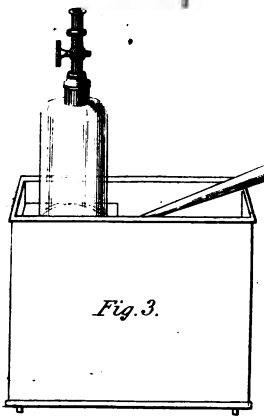
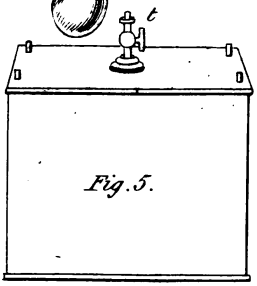
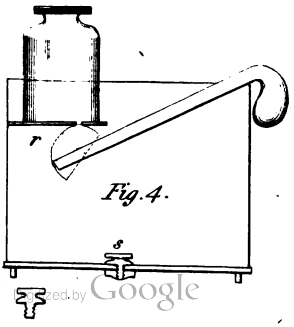


Mr. Cuthbert's hydro-pneumatic apparatus.









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Drawn by R. Cocking. Engraved by A. W. Warren.

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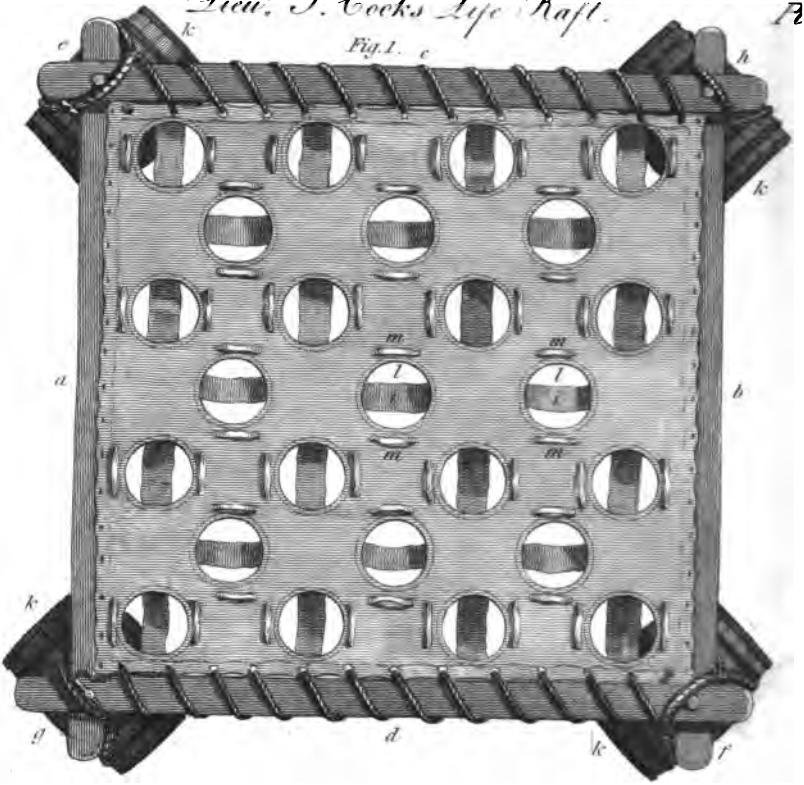
Lieut.t T. Cock's Life Raft.

Fig. 1.



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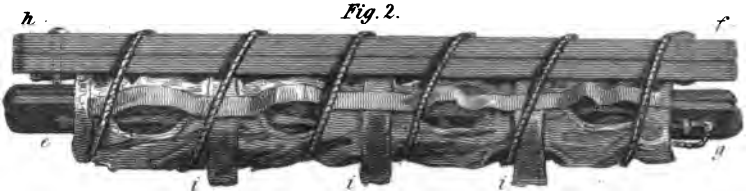

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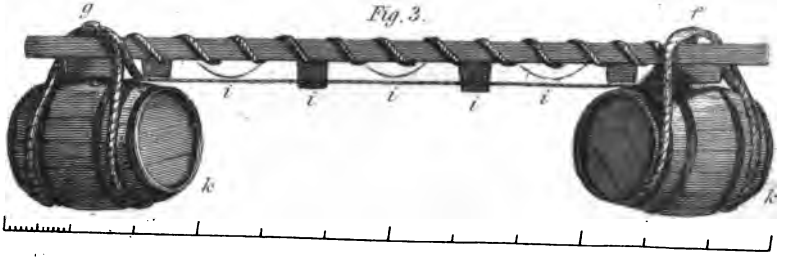

Drawn by C. Varley.

Scale of Twelve Feet.

Engraved by A.W. Warren.

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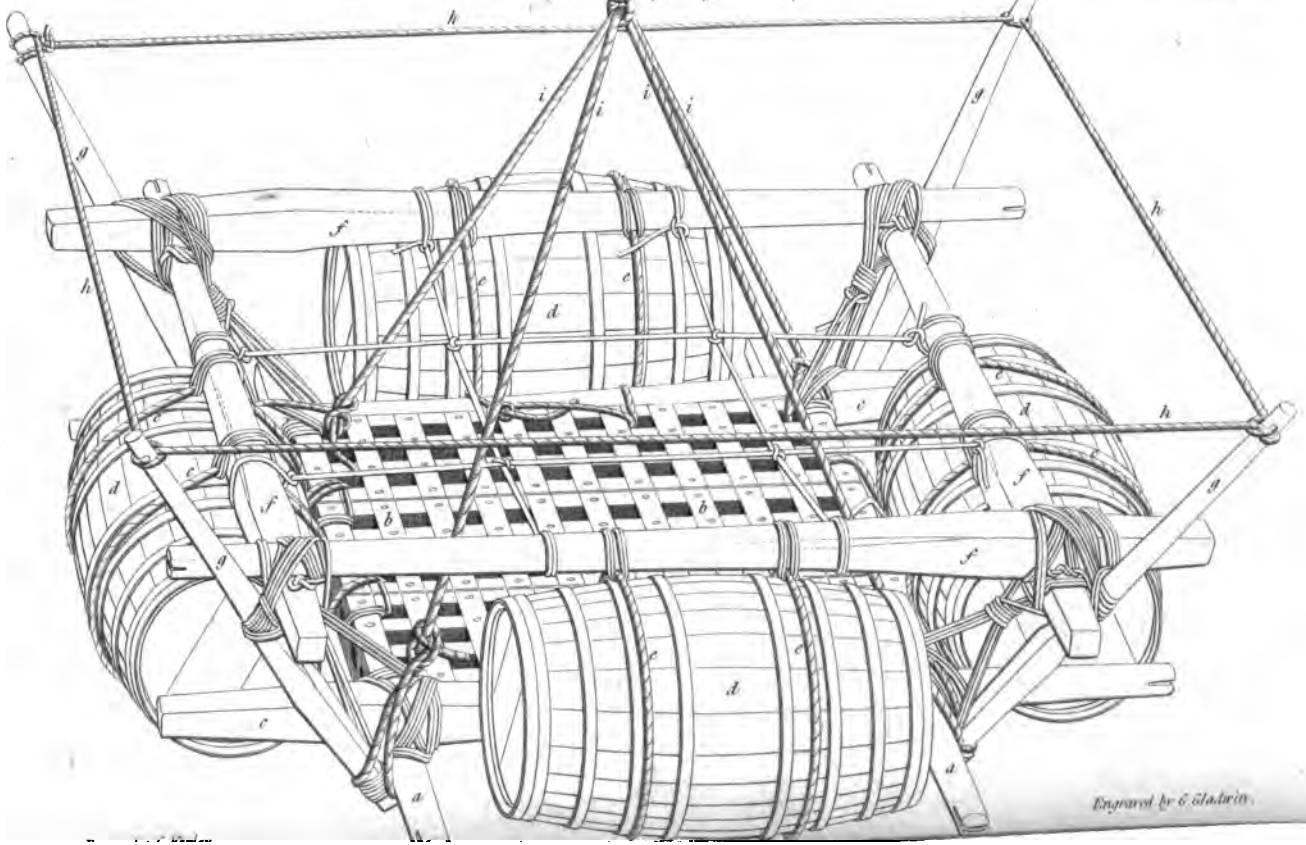
Lieut W. Rodger's Life raft.

Pl. 17.



Engraved by C. Gladwin.

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Mr. Donkin's Counting Machine. Pl. 18.

Fig. 1.

Fig. 2.

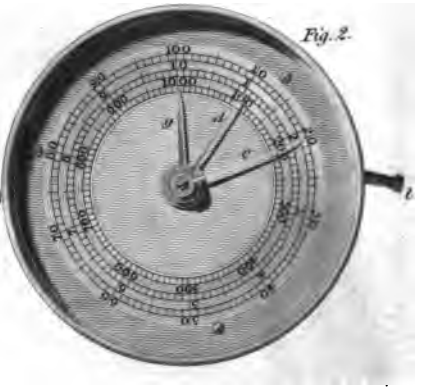
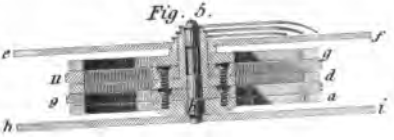


Fig. 4.

Fig. 3.

Fig. 5.



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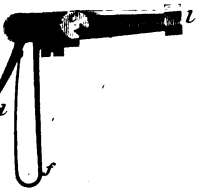


Fig. 12.

Fig. 11.

Fig. 10.

Fig. 7.

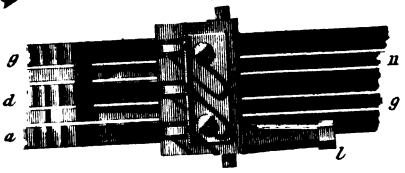
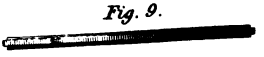


Fig. 9.



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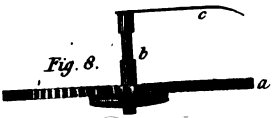

Drawn by Jos.h Clement.

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Engraved by James Davis.

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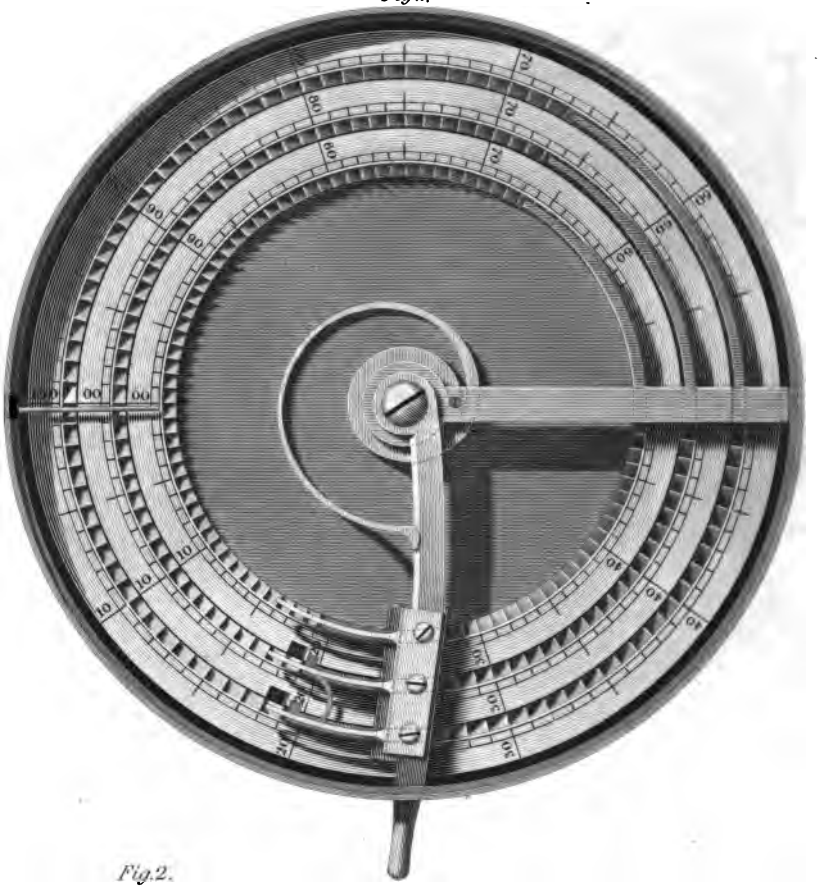
Mr. Donkin's counting machine. Pl. 19.

Fig. 1.



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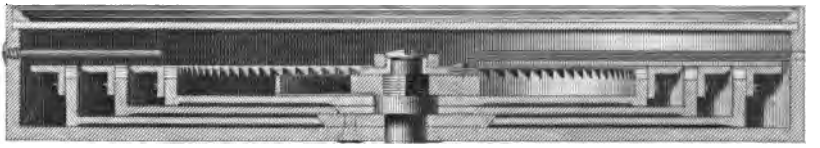

Fig. 5.

Fig. 3.

Fig. 4.

Drawn by J. Clement. Engraved by J. Davis.

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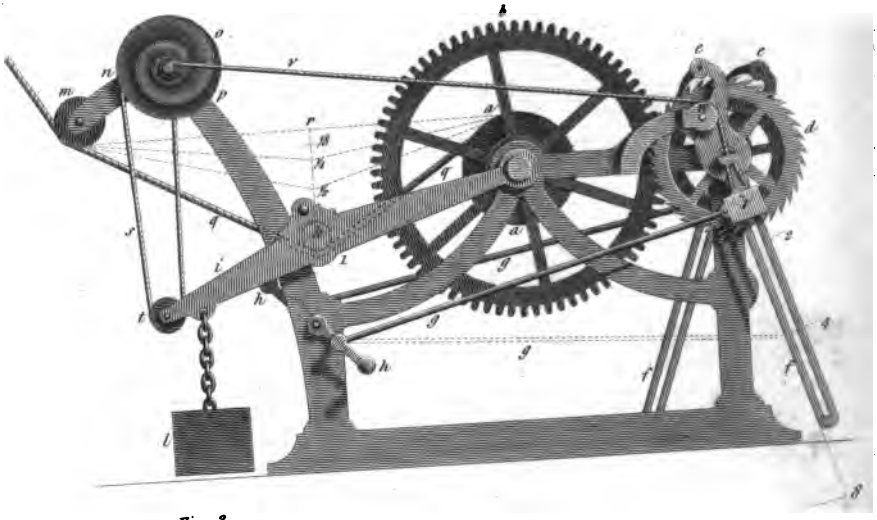
Fig. 1.



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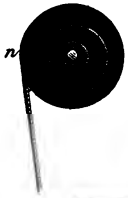

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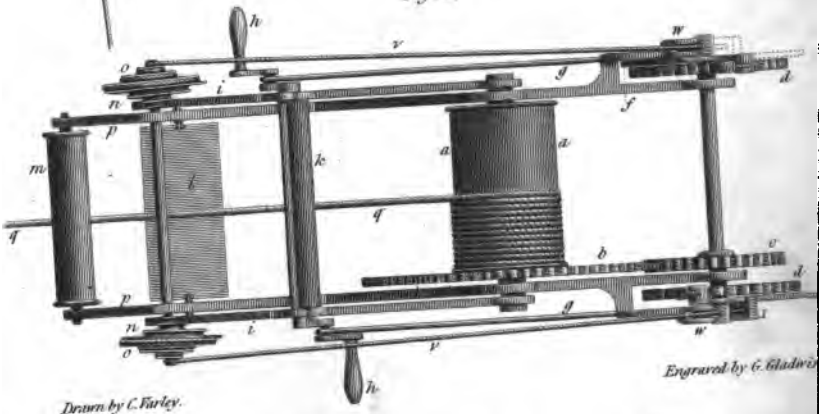

Drawn by C. Farley.

Engraved by G. Gladwin

Mr. A. Aengeis self adjusting Crane.

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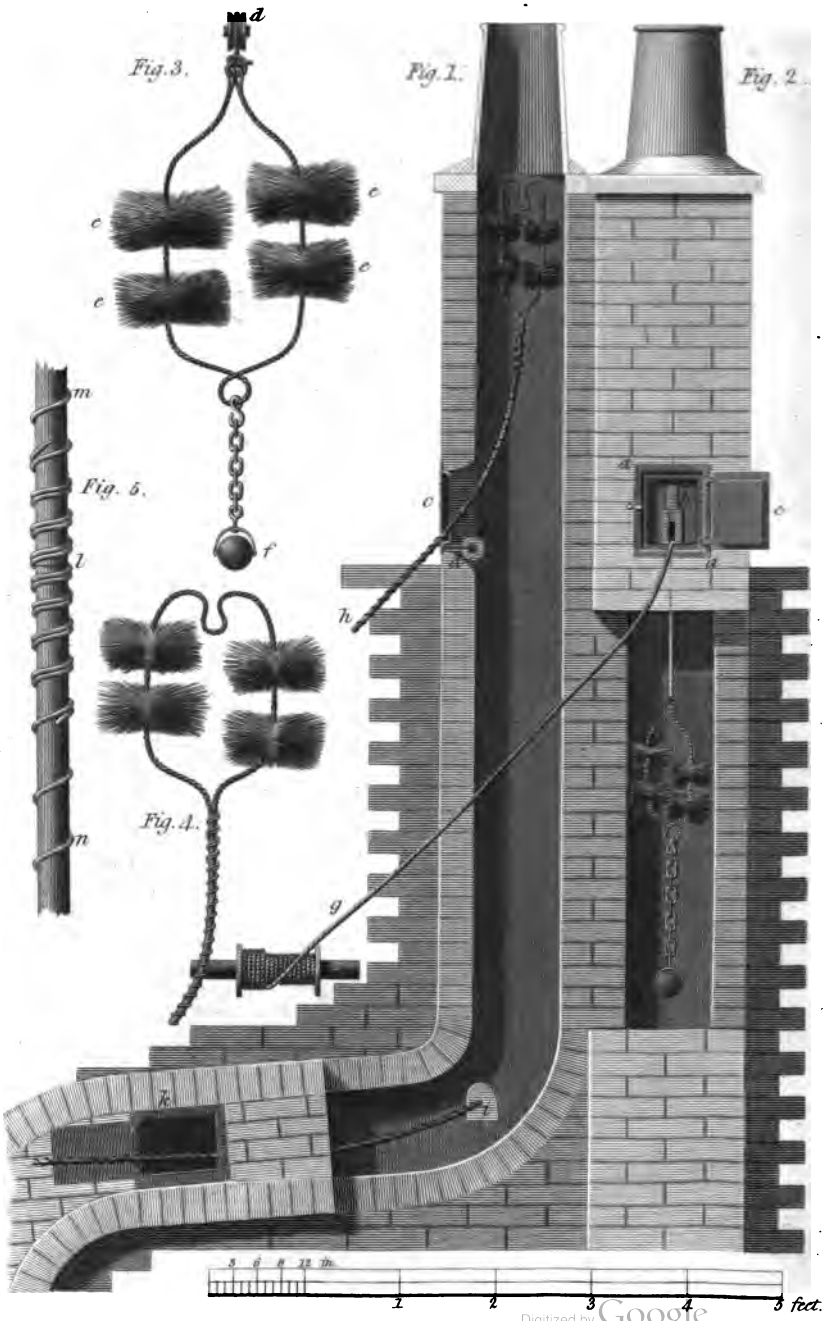
Mr. Feetham's Chimney-sweeping apparatus. Pl. 21



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Drawn by H. Cocking.

Engraved by J.B. Taylor.

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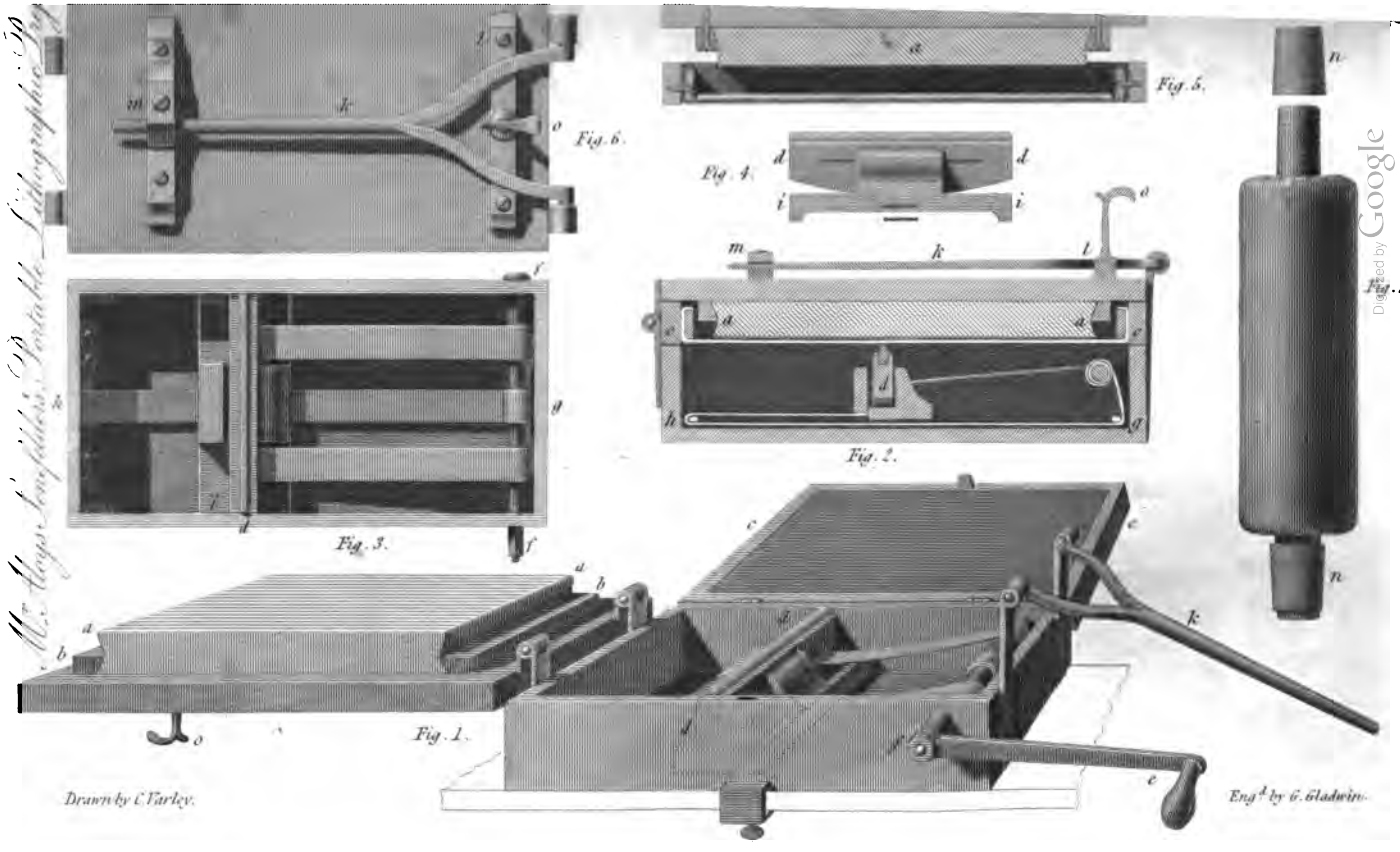
Mr. Hogg's Improved Portable Lithographic Press.



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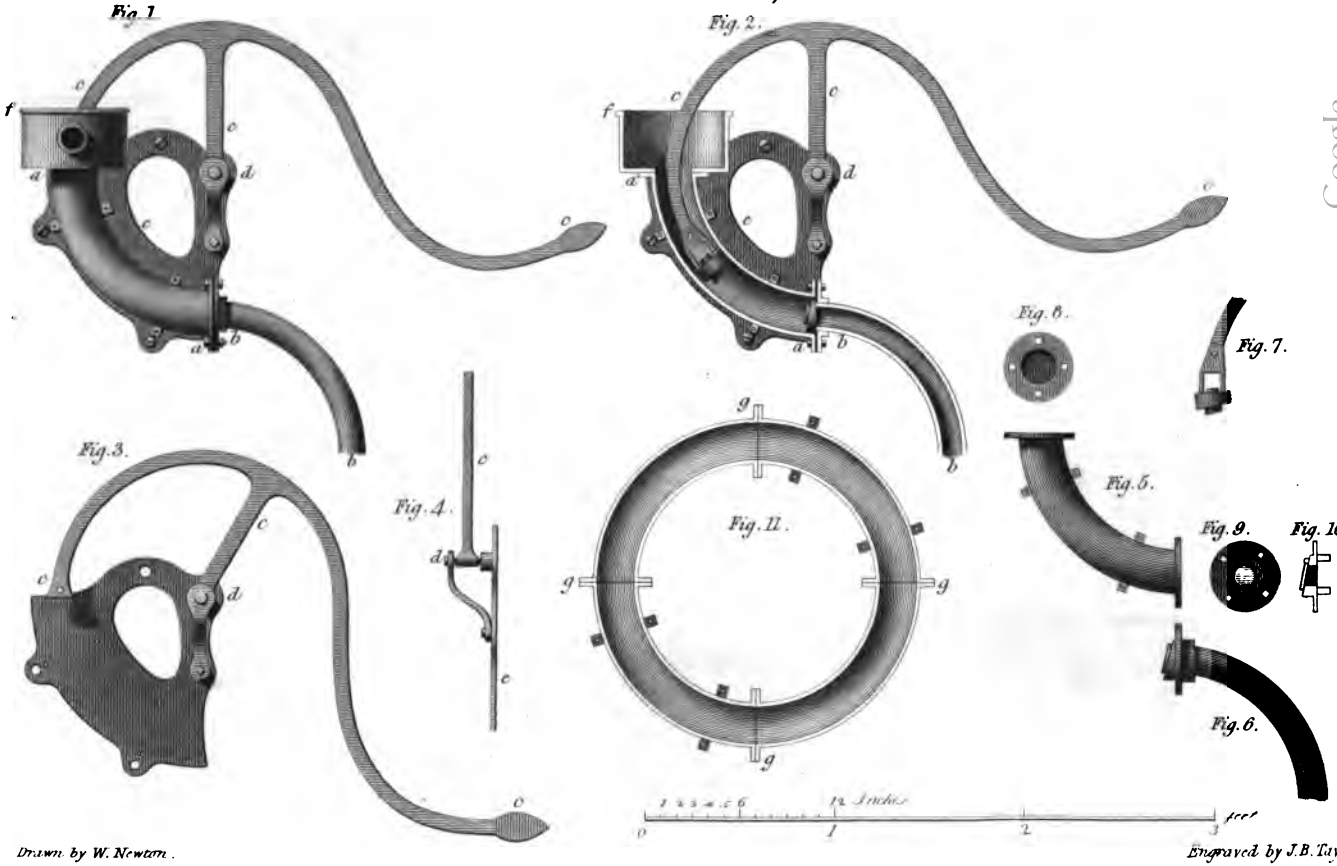

Drawn by W. Newton.

Engraved by J.B. Taylor.

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F.

Drawn by W.

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Mr. Hardy's spring Pendulum.

Drawn by J. Clement.

Engraved by Edm.d Burrell.

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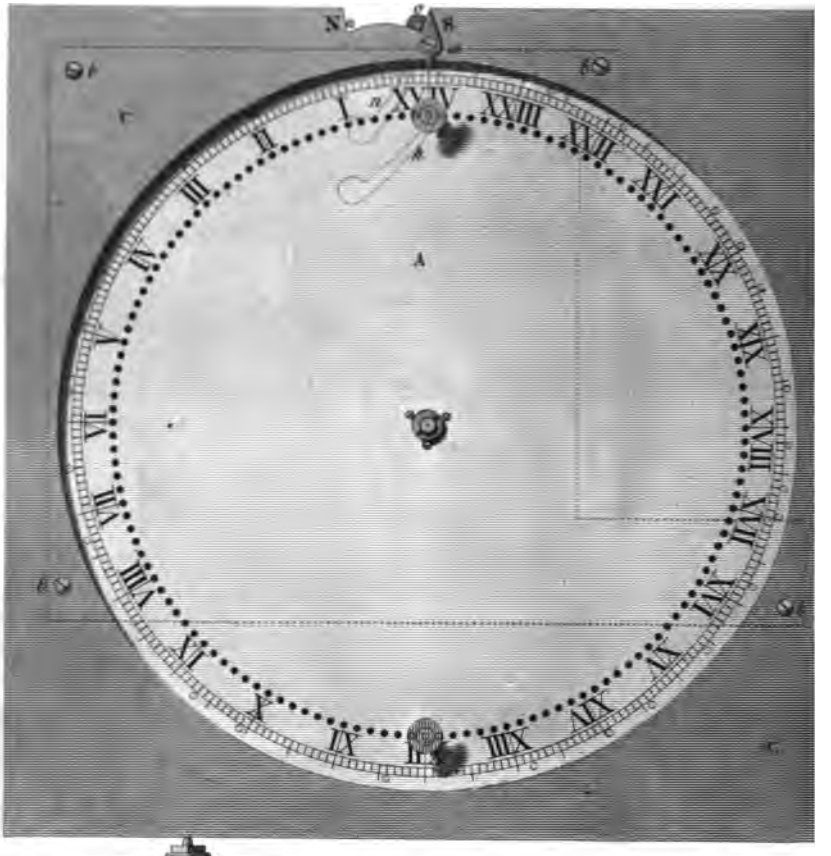
Mr. Thomas Tayl

Fig. 1.



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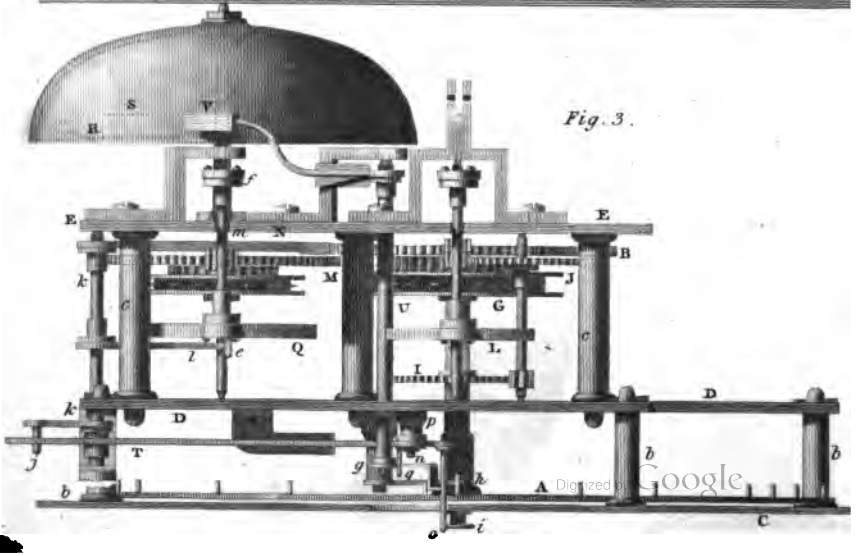

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Fig. 2.

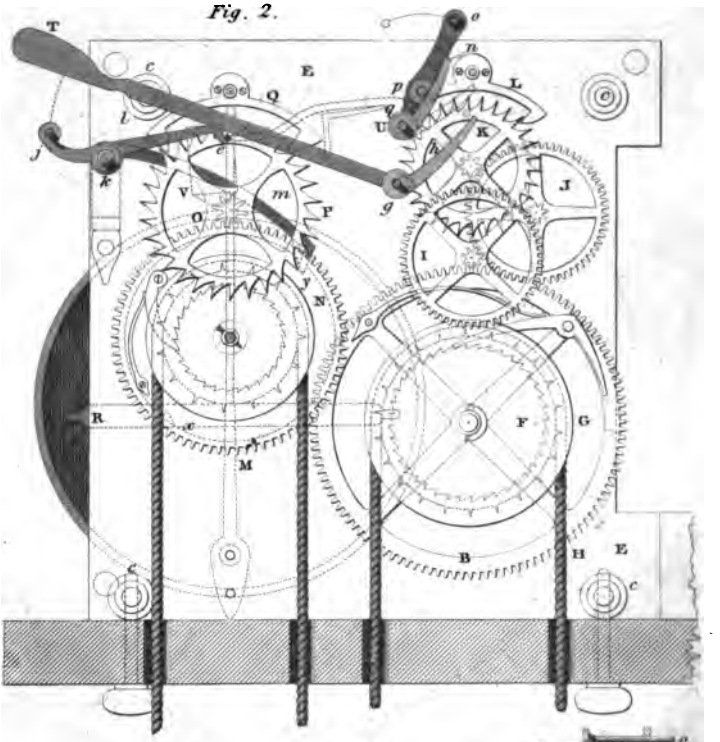
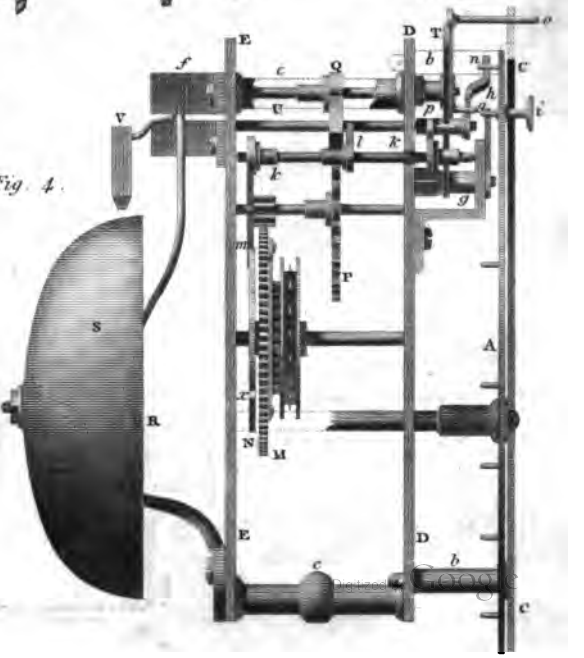


Fig. 4.



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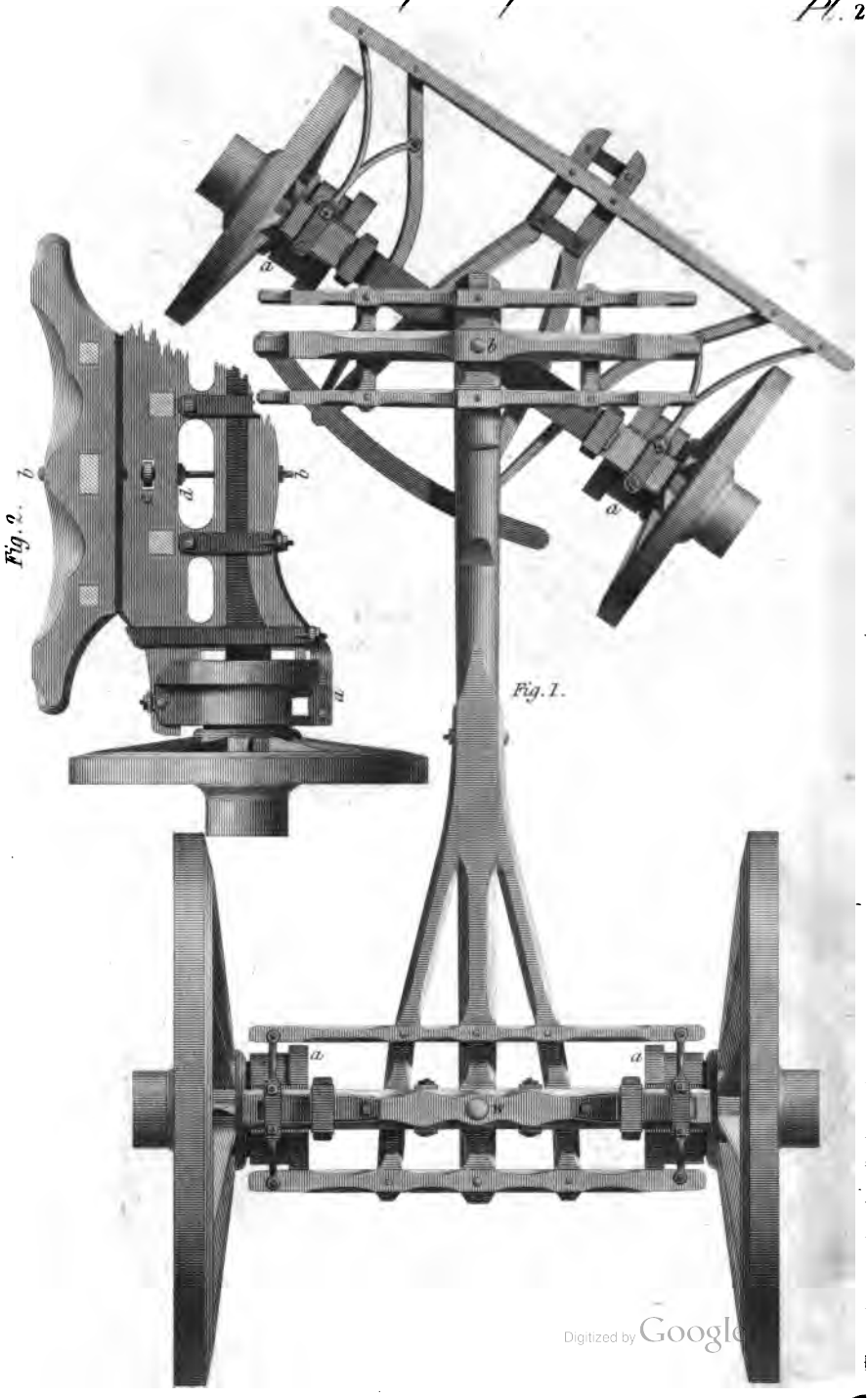
Mr. R. Phillips's improved axle.

Pl. 2



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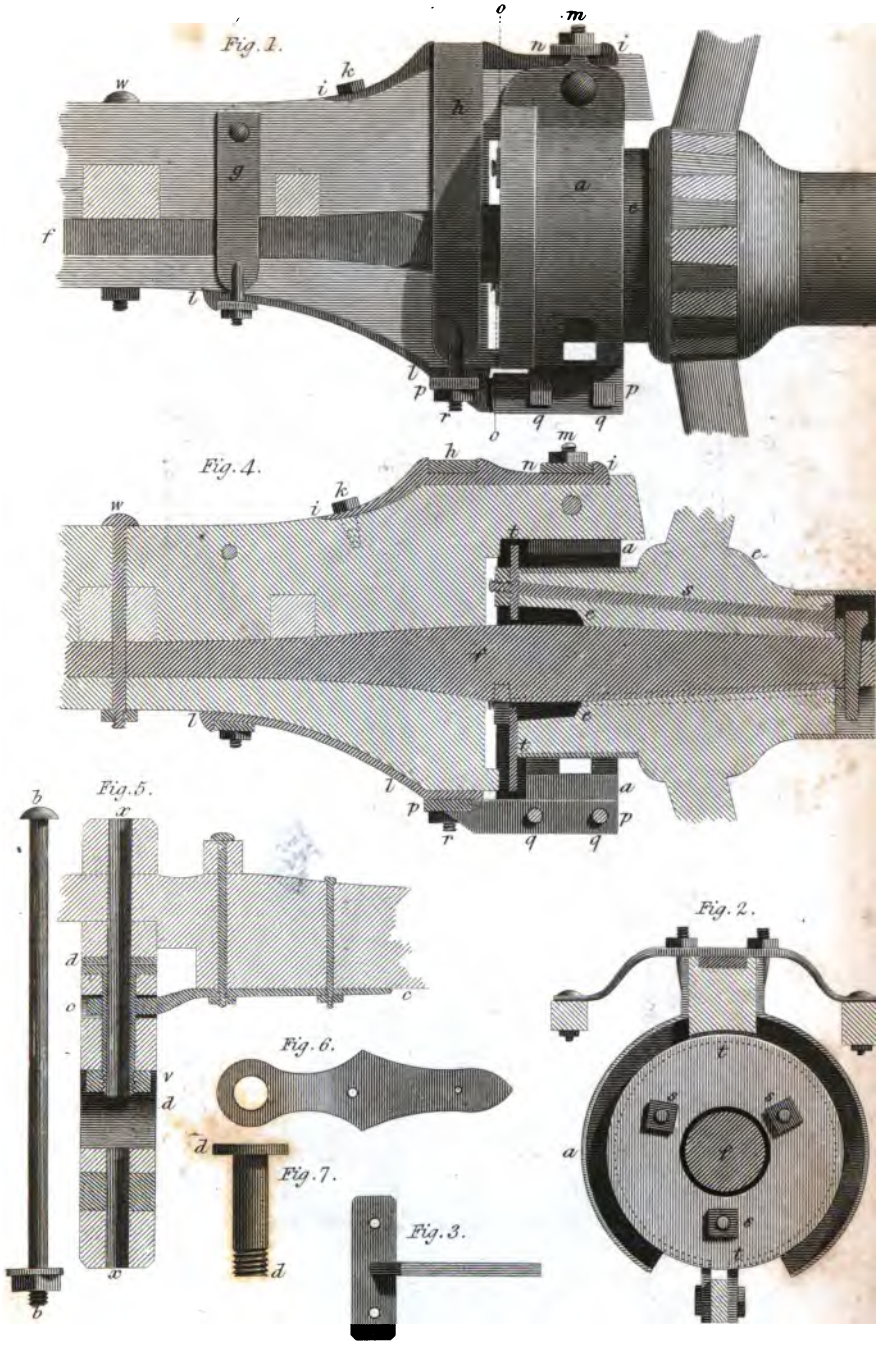
Mr. R. Phillips's improved axle.

Pl. 29.



Drawn by C. Varley.

Engraved by J.B. Taylor.

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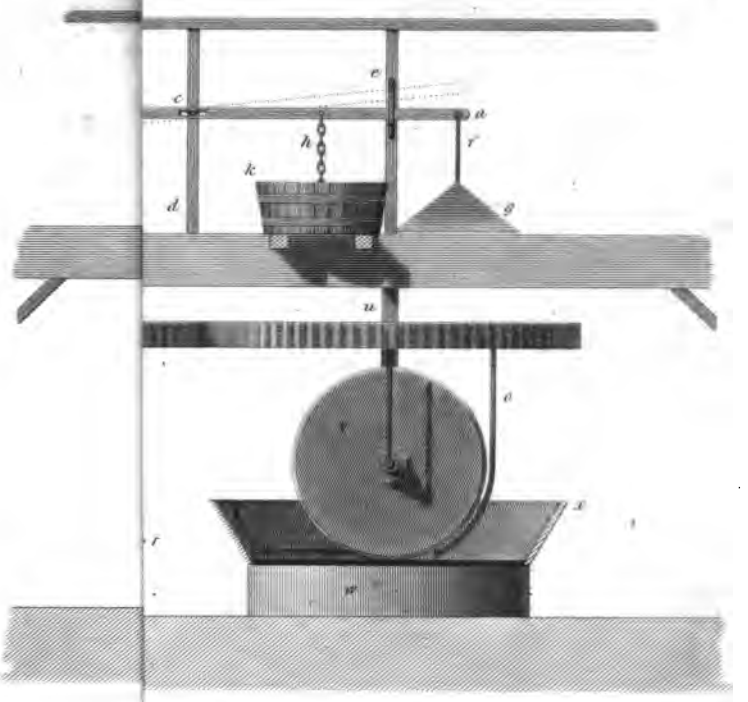

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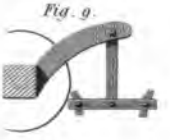

Fig. 9.

Fig. 11.

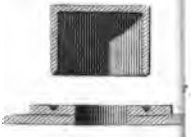

Fig. 10.

Drawn by W. Newton.

Engraved by S. Porter.

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Mr. J. Malam's Impr

Fig. 1.

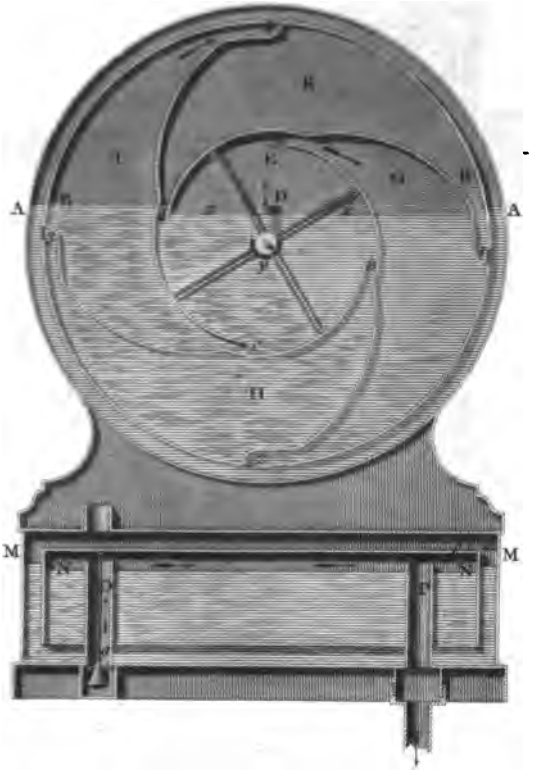
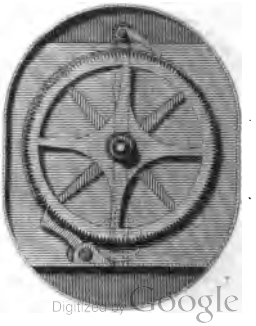


Fig. 4.

Fig. 5.



Newton, del.

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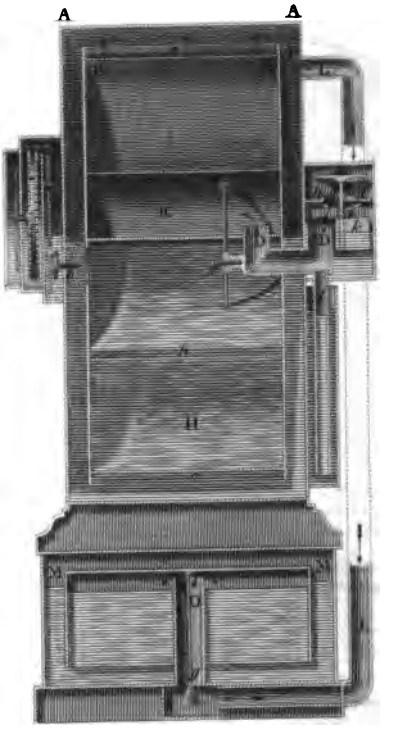
hroved Gas Meter.

Plate. 31.

Fig. 2.



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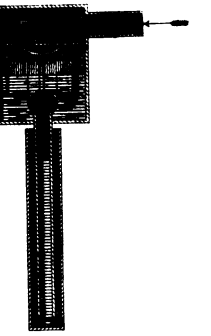

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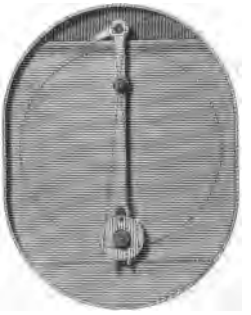

Fig. 7.

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Edm.d Turrell, sculp.

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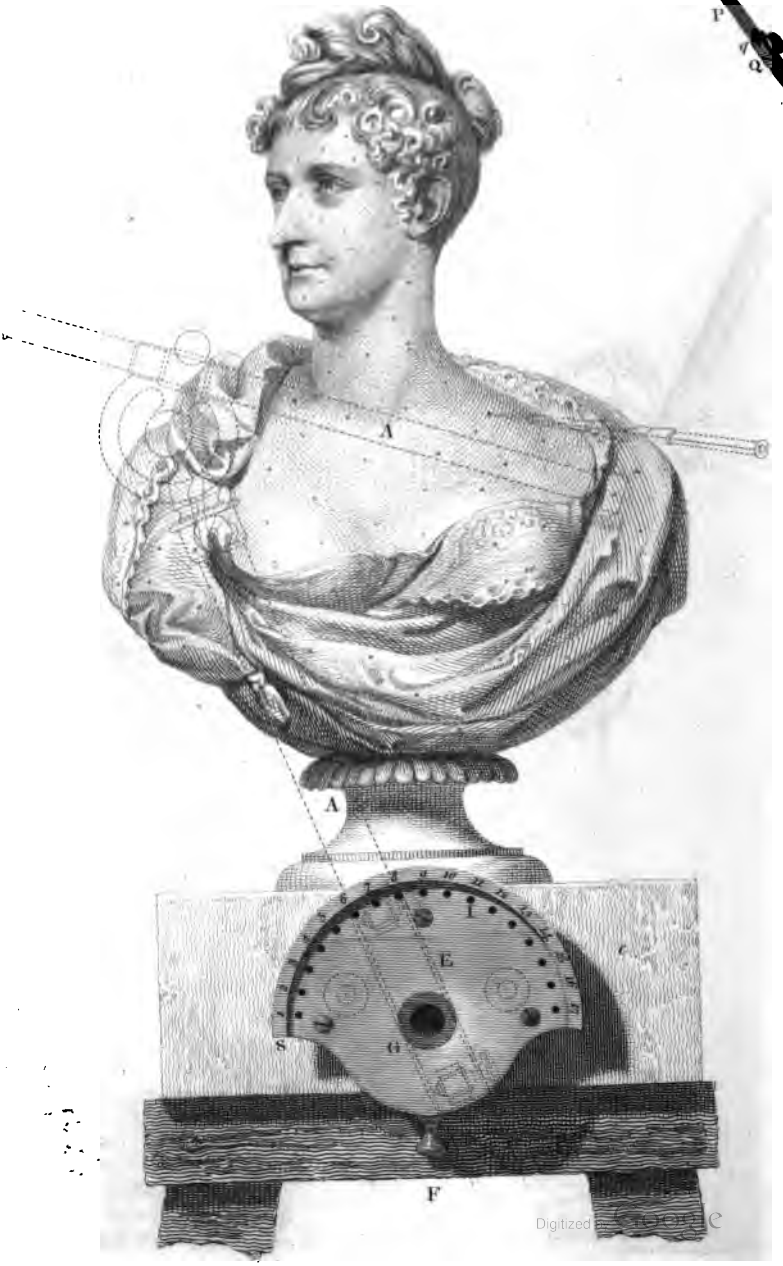
Mr. Behner's Inst

Fig. 1.



W. Behnes. del.

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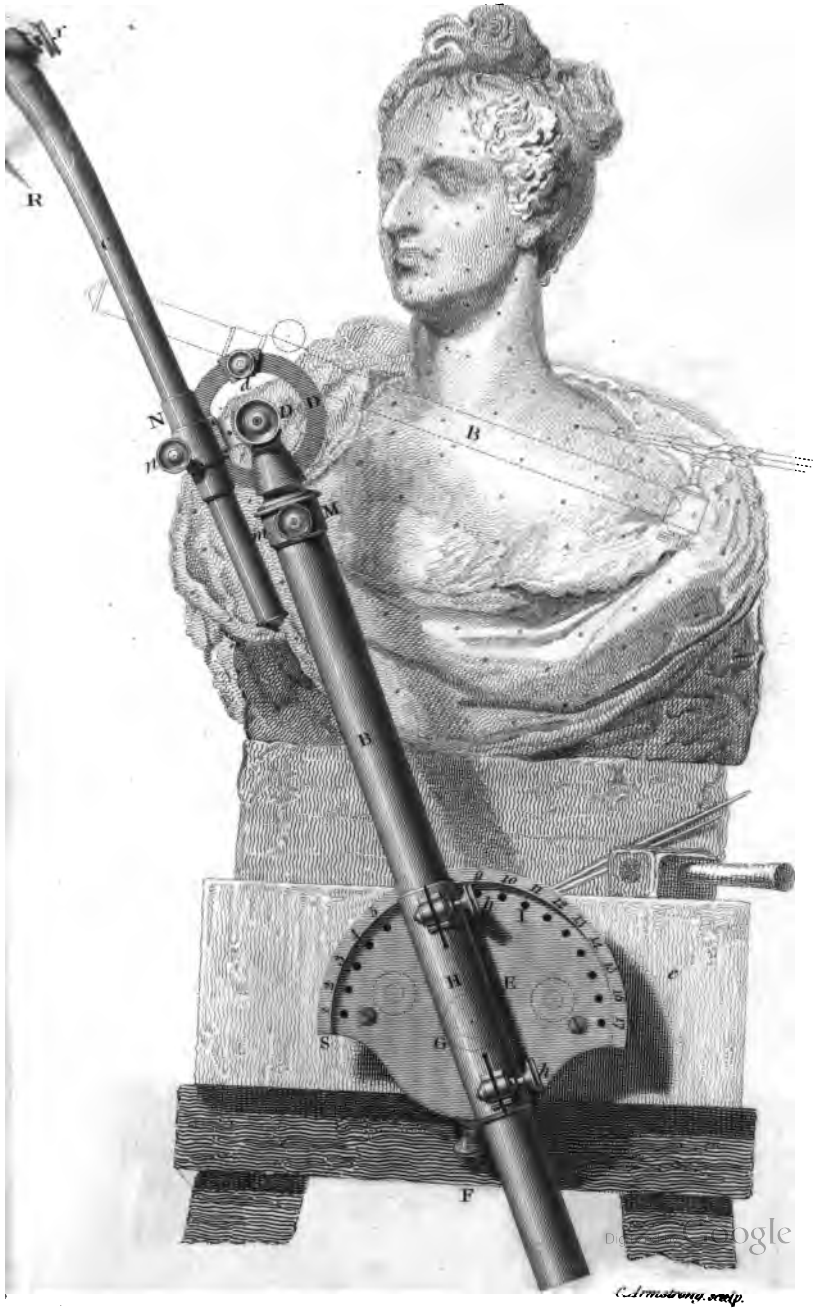
ument for Sculptors.

Fig. 2.



C. Armstrong. sculp.

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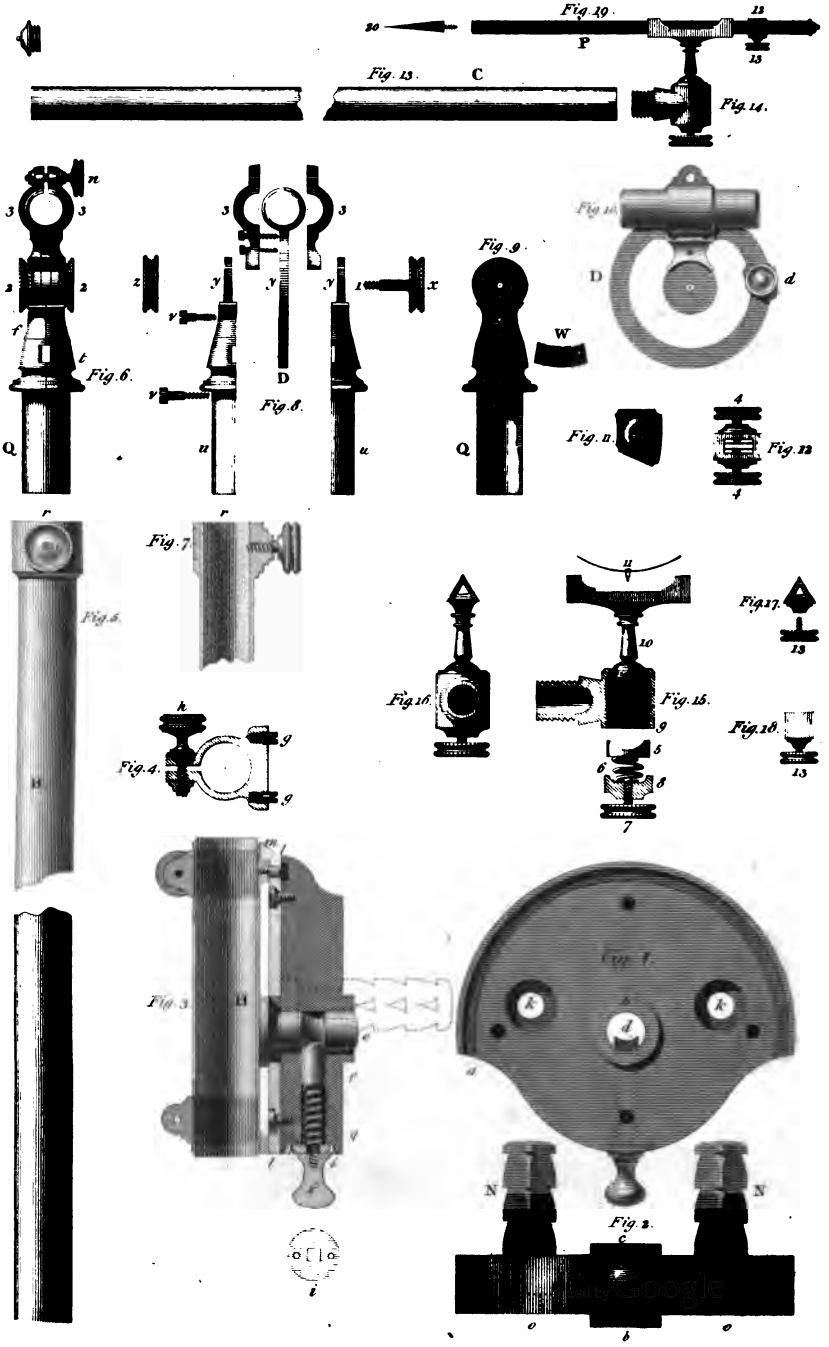
Mr. Behnes's Instrument for Sculptors



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A CATALOGUE

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MODELS, MACHINES,

AND DRAWINGS OF THE SAME, &c.

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Agriculture.—Class I.

A MACHINE for weighing and binding Hay, from Mr. J. Beckway. See page 15.

A Fruit-Gatherer, from Mr. T. Lane. See page 20.

Mr. John Young's Apparatus for collecting and preparing British Opium. See page 23.

A Churn, from Mr. E. Roberts. See page 40.

In Chemistry.—Class II.

Mr. W. Cook's Specimen of preserved Anatomical preparations. See page 43.

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Specimens of Lithography. See page 53—58.

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Mr. D. Napier's Tracing Instrument. See page 63.

Mr. J. Barraud's Strings to his Improved Violoncello. See page 67.

IN MANUFACTURES.—CLASS IV.

Mr. G. Rhodes's Machine for Drying Woollen Warps. See page 74.

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Printed by T. C. Hansard, Peterborough-court, Fleet-street, London.

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TRANSACTIONS

OF THE

SOCIETY

FOR THE ENCOURAGEMENT OF

ARTS, MANUFACTURES, AND COMMERCE.

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His Royal Highness The Duke of Kent.

K. G. &c. &c.

Late a Member of the Society

for the Encouragement of Arts Manufactures & Commerce.

Engraved by Chas. Warren from the original Picture by Sir William Beechey,
in the possession of his Royal Highness the Duke of Sussex.

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TRANSACTIONS

OF THE

SOCIETY,

Instituted at London,

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES, AND COMMERCE;

WITH THE

PREMIUMS OFFERED IN THE YEAR 1820.

VOL. XXXVIII.

LONDON:

SOLD BY THE HOUSEKEEPER, AT THE SOCIETY'S HOUSE

IN THE ADELPHI;

AND BY ALL BOOKSELLERS.

[*Price Fifteen Shillings.*]

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PREFACE.

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PREFACE.

IF the value of the communications made to a Society, be considered as a true index of the estimation in which it is held by the Public, the members of the Society of Arts, &c., have ample reason for satisfaction on reviewing the subjects rewarded during the last Session, and now forming the 38th Volume of their Transactions.

The Committee of Correspondence and Papers, under whose superintendance the communications composing the annual volume have been prepared for the press, and illustrated by explanatory engravings, have bestowed an unusual degree of time and attention on this most important duty. They have expedited, by every means in their power, the operations of the Draftsmen, the Engraver, and the Printer, being fully sensible how greatly the interests of the Society and of the several Candidates are benefitted by an early publication: they have the pleasure to find that their labours in this

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respect have been successful, and trust that in future they will be attended by an equally satisfactory result.

In order that the Public and those of the members who have not had an opportunity of attending the meetings of the Committees and of the Society at large, may be enabled to form an adequate estimate of the value of the volume which is now presented to them, it may not be out of place to take a brief and general view of its contents.

In the class of Agriculture, the account of the Duke of Devonshire's extensive plantations in the ancient but wasted forest of Inglewood, demonstrates the attention that continues to be paid by the greatest landholders in the country to this interesting branch of rural economy. Mr. Young's letter shows the successful progress of the cultivation of opium in Britain; an object which, after many unsuccessful attempts, from following too closely the practice in India and in Turkey, seems now, by the perseverance and skill of the gentleman just named, to be completely attained.

In the class of Chemistry will be found Dr. Hibbert's interesting communication respecting his discovery of Chromate of Iron, in Shetland; a mineral to which the painter is indebted for his

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most brilliant yellow pigment, and the enameller and porcelain manufacturer for their purest greens. This mineral, which has hitherto been found in a state of purity and abundance fit for the manufacturer, only in the territory of the United States of America, is now, by the happy application of mineralogical science on the part of Dr. Hibbert, demonstrated to exist in considerable abundance in our own country.

The Glaze for Porcelain communicated by Mr. Rose, of the Coalport China works, is another example of the successful practical application of our own mineral productions; and from its intrinsic merit in not debasing the tone of the most delicate colours, will contribute to the reputation of British porcelain, which is now beginning to enter into active competition with the finest fabrics of this ware in Europe.

In the class of Polite Arts will be found a very important communication from Messrs. Perkins, Fairman and Heath, on their method of perpetuating and multiplying to an almost indefinite extent, the finest productions of the engraver. This method well deserves encouragement, considered merely as a means of rendering cheaper, and therefore more generally accessible, those graphic illustrations by which the acquisition of many branches of knowledge is greatly facilitated. But it is entitled to put

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forth a higher claim to the public estimation as the most probable mode by which the forgery of bank notes may be checked and perhaps prevented. The Society of Arts have already publicly evinced the interest which they take in the removal of this great opprobium on our age and nation; and if by continuing to call the attention of the public to the encouragement of those plans which appear the best calculated to prevent the perpetration of this crime, their efforts shall finally be crowned with success, no words will be able adequately to express their satisfaction.

The class of Mechanics contains, as usual, a greater number of communications than all the rest combined. Of these, Mr. Hardy's beautiful Escapement, the perfection of which has been demonstrated by ample trials, deserves perhaps the first place. In this construction friction is almost wholly done away with, a much less maintaining power is required, and the isochronism of the vibrations appears to be as perfect as the properties of matter itself will permit. Mr. Perkins's method of drawing off the Back Water from Water-Wheels, greatly increases the power of these machines, and enables the manufacturer to take full advantage of those periods when an abundant flow of water affords the means of performing the greatest quantity of work. The Ships' Pump of the same gentle-

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man being capable of being made by any carpenter out of materials which are necessarily to be found on board every ship, offers an important and efficacious resource to the mariner in times of peculiar peril.

Mr. Hookey's improvements in the construction and adaptation of Ships' Rudders are calculated to prevent accidents from hawsers getting foul of them; they also increase the rate of sailing, by preventing the retardation occasioned by the rudder on the common construction, and at the same time give it better hold on the water, and consequently greater command of the ship.

Captain Burton's Apparatus for applying the manual power of the crew to give a progressive motion through the water to Ships of War on a lee shore, or when becalmed under an enemy's batteries, has been proved, by experiment, on board His Majesty's ship Active, and on this account is now offered to the public.

The Bellows or Blowing Machine of Messrs. Jeffries and Halley needs only be seen to be approved. The small space which it occupies, the ease with which it is worked, the unintermitting and efficacious blast that it delivers, have, in the course of a few months, occasioned its adoption in so many public and private forges as completely to

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justify the liberality of the Society towards its ingenious inventors.

Mr. Austen's method of adjusting and supporting the Bed-stone of a Corn Mill enables the miller to ensure the perfect parallelism of the stones, and by that means to increase both the quality and quantity of the flour.

Mr. Jopling's rules for the formation of Ribs for Groined Arches will, no doubt, be duly appreciated by the practical architect: a greater regularity and symmetry are obtained and at a less expense than in the ordinary mode of construction.

Mr. Holdsworth's Arched Timber Roofs exhibit a happy application of Mr. Hookey's method of bending Timber for Naval Uses to the purposes of domestic carpentry; a secure, roomy, and economical roof is thus obtained, and which, upon trial on a large scale, appears to accomplish every purpose aimed at by its inventor.

Mr. Cherry's Blocks and Auxiliary Springs for Carts and other Carriages adapt these machines for more extensive service; and at the same time that they diminish their wear and tear, prevent also the ruinous concussions to which articles of furniture and other perishable materials are liable when conveyed in carts of the ordinary construction.

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Contrivances for the preservation of human life have always experienced a ready attention from the Society of Arts, and a liberal reward in proportion to their merit. From this feeling a substantial mark of approbation has been conferred on Mr. Trengrouse, for his method of effecting a communication between a stranded ship and the shore by means of a Rocket, and for the unwearied zeal with which he has endeavoured to get his plan introduced into practice. From a similar feeling, combined with approbation of the ingenuity and mechanical skill displayed by Mr. Elliott, in his Safe Coach, the Society have conferred on him their Gold Medal, the highest reward which any member can receive.

In the last Volume, under the class of Colonies and Trade will be found an interesting account of the successful endeavours of Mr. Denovan, of Leith, to cure Scotch Herrings according to the Dutch method. For this the Society conferred upon him a considerable pecuniary reward. A similar testimony of their approbation has since been bestowed on the same candidate for the introduction of Scotch Herrings into the Hamburgh market, cured under his directions and superintendance with so much skill as secured to them the first price at that celebrated mart. The possibility of entering into successful competition with the Dutch

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fishermen at the chief market in Europe for this commodity having been thus demonstrated, the Society may with perfect confidence leave to the known skill and activity of our merchants and seamen the task of following up and securing an advantage, the road to which is now opened and pointed out to them.

The above are the principal, though by no means the whole contents of the Volume now offered to the Public. It has not been thought necessary in this rapid summary to particularize every communication, although the rewards bestowed, whether honorary or pecuniary, were not given without due deliberation, and a conviction that in so doing the Society were conscientiously assigning an adequate reward for the degree of merit displayed in each particular case. The only recompense that the Society looks to and can possibly receive, is that of being considered by their countrymen as having contributed as far as their limited means allow, first, to the welfare of that national community of which they are proud to bear the name, and ultimately to that of civilized society at large.

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THE Society take the present opportunity of returning their Thanks to the different Public Bodies and Individuals who have honoured them with Presents during the Session, the particulars of which are noticed in the body of the Volume. Without presuming to direct in what channels the liberality of the friends to this Institution shall flow, it may be stated that such contributions as may put the Society in possession of a compleat collection of all the Publications of any value on the application of Mathematics to practical Mechanics, will be especially acceptable.

The Society desire it to be clearly understood, that as a Body, they are not responsible for any Opinion, or Representation of Facts, contained in the following Pages.

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Premiums offered

IN THE SESSION 1820—1821.

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A LIST of the OFFICERS of the SOCIETY.

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ADVERTISEMENT TO THE PUBLIC.

THE chief object of the SOCIETY is, to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for all such useful Inventions, Discoveries, and Improvements (though not mentioned in these Premiums) as tend to that purpose; and, in pursuance of this plan, the SOCIETY have already expended upwards of EIGHTY-FIVE THOUSAND POUNDS, advanced by voluntary subscriptions of Members, and legacies bequeathed.

The Register of Premiums and Bounties which they have given, and which may be seen at the SOCIETY's house in the Adelphi, will show the very great advantages derived by the Public from this Institution.

The meetings of the SOCIETY are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The several Committees meet on other evenings in the week during the session, as particularly mentioned in their printed book of Rules and Orders.

In order still farther to promote the laudable Views of the SOCIETY, it may be necessary to explain the mode by which members are elected.

Each member has the privilege, at an ordinary meeting of the SOCIETY, or by letter to the Secretary, to propose any person who is desirous to become a member; such proposal to contain the name, full addition, and place of abode, of the proposed Member, and to be signed by three members of the SOCIETY.

Peers of the Realm, or Lords of Parliament are, on their being proposed, immediately balloted for; the names of other persons proposed to become Members are read by the Secretary to the SOCIETY, and are then inserted in lists which are hung up in the SOCIETY's room; they are balloted for at the second following ordinary meeting. In both cases, if two-thirds of the Members then voting, ballot in their favour, they are deemed Perpetual Members upon payment of not less than Twenty Guineas in one sum, or Subscribing Members upon payment of any sum not less than Two Guineas annually.

All Members are entitled to vote and assist in all the business of the SOCIETY and of the several Committees. The Members have also the privilege of recommending two persons as visitors at the meetings of the SOCIETY; and by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various Models, Machines, and Productions, in different branches of Arts, Manufactures and Commerce, for which rewards have been bestowed; also to inspect the magnificent series of Moral and Historical Paintings, executed by the late J. BARRY, Esq. which, with some valuable Busts, Statues, Portraits, &c. decorate the public rooms of the SOCIETY.

Members have the use of the SOCIETY's Library, which is valuable, and annually increasing by the purchase and donation of scientific and useful books, and of engravings. The SOCIETY are highly sensible of the great importance of such acquisitions, and are happy to record them, with the names of the donors, in the Volume annually published of the SOCIETY's Transactions, to which the Members are entitled.

Ladies are eligible, as Members of the SOCIETY, to all the Privileges thereof, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a Member, on his producing a written authority for the same.

The SOCIETY desire it to be clearly understood, that as a Body they are not responsible for any opinion or representation of facts contained in their Volumes. And the Public are requested to guard against impositions, from persons advertising as having Patents for Articles rewarded by the SOCIETY. It is a stipulated condition, that all Persons who receive Premiums or Bounties from the SOCIETY, shall

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relinquish all pretensions to a Patent for Articles so rewarded, and shall allow them to be made or manufactured by any Person whatever.—The Public are also cautioned against purchasing articles sold under the pretended sanction of the Society's Name

The consideration of the Claims for the Premiums offered in the present List, will take place during the Session of the Society commencing on Wednesday, the 1st of November 1820. The several Candidates and Claimants, to whom the Society shall adjudge Premiums or Bounties, are to attend on the last Tuesday in May, at eleven o'clock in the forenoon precisely, to receive the same, that Day being appointed by the Society for the Distribution of their Rewards; and before that time no Premium or Bounty will be delivered, except to those who are about to leave the Kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, Deputies may be substituted to receive the rewards, provided such Deputies are either Members of the Society, or superior Officers thereof.

Since the last Distribution of Rewards, *One Hundred and Ninety Six* New Members have been elected.

The Society have lately published the 37th *Volume* of their Transactions, which may be had by Members on application to the Housekeeper. Complete Sets of their Transactions, or any single Volume, may be purchased at the Society's house: Also

An *Analytical Index of the First Twenty-five Volumes* of the Transactions, to the termination of the Session, June 1807, price 2*s.* 6*d.*

A List of the Machines and Models in the Society's Repository, to the year 1813, inclusive.

A Catalogue of Books in the Society's Library, 1*s.*

A description of Mr. Barry's Paintings in the Great Room of the Society.

GENERAL CONDITIONS.

As the great object of the Society in rewarding individuals, is to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large, Candidates are requested to observe, that if the means by which the respective objects are effected, require an expense or trouble too great for general purposes, the Society will not consider themselves bound to give the offered reward; but, though they reserve the power of giving in all cases, such part only of any premium as the performance shall be adjudged to deserve, or of withholding the whole if there be no merit, yet the Candidates may be assured the Society will always judge liberally of their several claims.

All Candidates are to take notice, that no claim for a premium will be attended to, unless the conditions are fully complied with.

The models of all machines, which obtain premiums or bounties, shall be the property of the Society.—The Premiums are designed for the United Kingdom, unless expressly mentioned to the contrary.—The claims will be determined as soon as possible after the delivery of the specimens.—It is expected that all articles for claims or bounties be sent to the Society, carriage paid.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained or purposes to obtain, a patent, or for which he has obtained any premium or reward from any other Society.

A Candidate for a premium, or a person applying for a bounty, being detected in any disingenuous method to impose on the Society, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

No member of this Society shall be a Candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medal of the Society. The Candidates are, in all cases, expected to furnish a particular account of the subject of their claims; and where certificates are required to be produced in claim of Premiums, they should be expressed, as nearly as possible, in the words of the conditions attached to the respective premiums, and be signed by disinterested persons who have a positive knowledge of the facts stated.

Where premiums or bounties are obtained in consequence of specimens produced, the Society will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No Candidate, not a member, shall be present at any meeting of the Society or Committees, or admitted at the Society's rooms, after they have delivered in their claims, until such claims are adjudged, unless summoned by the Committee.

The Society, anxious to promote the Arts of their country, have adopted the resolution of forming a Collection of Prints, to be open for public inspection; and, having arranged those already in their possession, invite engravers to send etched, or finished proofs of their plates; and hope that amateurs, collectors, and publishers of works of art, will also contribute to the undertaking.

Prints of Machines, or Maps, will also come within this arrangement.

The Society farther invite the communications of scientific and practical men, upon all subjects connected with the views of this Society, although their experiments may have been conducted upon a smaller scale than the terms required by the premiums; as such communications may afford ground for more extensive application, and thus materially contribute to the advantage of the public.

The Library of the Society, which has already become very valuable, may yet receive considerable additions and improvements from the presents of members, or other persons who may be inclined to place useful books or valuable manuscripts in a repository at once permanent and conducive to the national benefit.

All communications are to be made by letter, addressed to Arthur Aikin, Esq. the Secretary, at the Society of Arts, &c. Adelphi, London.

And where articles are sent by Sea for the Society, the Bills of Lading are to be addressed to the care of William Vaughan, Esq, Mincing-lane, London, who has undertaken to receive them for the Society.

The Winchester bushel is the measure referred to for grain; and, as the acres of different districts vary in extent, it is necessary to observe, that the Society mean Statute Acres of five and a half-yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.

The Society desire that the Papers on different subjects sent to them may be full, clear, and explicit, fit for publication; and that descriptive drawings may be sent with the Models and Machines laid before the Society.

*** To persons inclined to leave a sum of money to this Society by Will, the following form is offered for that purpose.

Item.—I give and bequeath to A. B. and C. D. the sum of
upon condition and to the intent that they, or one of them, do pay the same to the Collector for the time being, of a Society in London, who now call themselves the Society for the Encouragement of Arts, Manufactures, and Commerce; which said sum of I will and desire may be paid out of my personal estate, and applied towards the carrying on the laudable designs of the Society.

The Society take this opportunity of returning their thanks to the several Societies and Individuals who have favoured them with Presents for their Repository and Library.

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PREMIUMS IN AGRICULTURE.

THE Candidates for planting all kinds of trees are to mention the nature of the Soil, to produce Certificates that the respective Plantations are properly fenced and secured, and particularly to state the condition of the Plants at the time of sending such Certificates. Any information which the Candidates for the following Premiums may choose to communicate, relative to the methods made use of in forming the Plantations, or promoting the growth of the several Trees, or any other observations that may have occurred on the subject, will be thankfully received.

It is the intention of the Society that such lands only as are not calculated for the purposes of husbandry, should be employed for the purposes specified in these Advertisements relative to Plantations.

ACORNS.

1. FOR having set, between the first of October, 1818, and the first of April, 1819, the greatest quantity of land, not less than ten acres, with Acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

2. For the second greatest quantity of land, not less than five acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young Oaks on each acre, to be delivered to the Society on or before the first Tuesday in February, 1821.

RAISING OAKS.

3. To the person who shall have raised, since the year 1816, the greatest number of Oaks, not fewer than five thousand, either from young plants or acorns, in order to secure a succession of oak timber in this kingdom;—*the Gold Medal.*

4. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates that there were on the land at least the number of young Oak Trees required, in a thriving condition, two years after the planting, with an account of the methods pursued in making and managing the plantation, to be produced to the Society on or before the first Tuesday in February, 1821.

THE BEST METHOD OF RAISING OAKS.

5. To the person who shall ascertain in the best manner by actual experiments, the comparative merits of the different modes of raising Oaks for timber, either from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on a smooth surface, or among bushes, fern, or other cover; or from young plants previously raised in nurseries, and transplanted: regard being had to the expense, growth, and other respective advantages of the several methods;—*the Gold Medal.*

The accounts and proper certificates that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in February, 1821.

ELM.

6. For having planted the greatest number of the English Elm, not less than eight thousand, between the 24th of June, 1818, and the 24th of June, 1819, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

7. For the second greatest number, not less than five thousand;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, that the plants were in a healthy and thriving

state two years at least after making the plantation, and specifying the distance of the plants, to be delivered to the Society on or before the first Tuesday in April, 1821.

LARCH.

8. For having planted out, between the 24th of June, 1817, and the 24th of June, 1818, the greatest number of Larch Trees, not fewer than five thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

9. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1821.

N. B. The Larch Trees may be planted either mixed with other trees, or by themselves, as may best suit the convenience of the planter.

ASH.

10. For having sown or set, in the year 1817, the greatest quantity of land, not less than six acres, with Ash for timber, with or without seeds, cuttings, or plants, of such other trees as are adapted to the soil;—*the Gold Medal.*

11. For the next greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of the sowing or setting, agreeably to the above conditions, that there are not fewer than six hundred Ash Plants on each acre, in a thriving and healthy condition, two years at least after the sowing or setting, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1821.

FOREST TREES.

12. To the person who shall have inclosed and planted, or set, the greatest number of acres (not less than ten) of land that is incapable of being ploughed, such as the borders of rivers, the sides of precipices, and any land that has too many rocks, or that is not calculated to repay the expense of tillage, owing to the surface being too hilly, mountainous, or otherwise unfit for tillage, with the best sorts of Forest Trees, namely, oak, Spanish chesnuts, ash, elm, beech, alder, willow, larch, spruce, or silver fir (with or without screens of Scotch fir) adapted to the soil, and intended for timber trees, between the first of Oct. 1817, and the first of April 1818;—*the Gold Medal.*

13. For the second greatest quantity of land; not less than seven acres;—*the Silver Medal.*

A particular account of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after making the plantations, to be delivered to the Society on or before the second Tuesday in February, 1821.

N. B. With the above Forest Trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

NORWAY FIR SEEDLINGS.

14. To the person who shall have planted in the united kingdom, during the year 1818, the greatest number, not less than two thousand, of red wood and white wood Norway Fir Seedlings, at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the first Tuesday in February, 1821.

N. B. It is recommended to plant the seedlings of about three or four years growth, and in a moderately good soil, somewhat sheltered; the wood from the district of Christiana is esteemed the best for carpenters' and joiners' use: and for spars and uphers the trees near to Long Sound are most valued.

CHESNUTS.

15. For having sown or set between the first of October, 1818, and the first of

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April, 1819, the greatest quantity of land, not less than six acres, with Spanish Chesnuts, with or without seeds, cuttings, or plants of other trees, adapted to such soil, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

16. For the second greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of sowing or setting, agreeably to the above conditions, and that there are not fewer than three hundred Chesnut Plants in a thriving state, on each acre, to be delivered to the Society on or before the first Tuesday in February, 1821.

WALNUT TREES.

17. For having planted the greatest number of Walnut Trees, not less than five hundred, between the 24th of June, 1818, and the 24th of June, 1819, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

18. For the next greatest number, not fewer than three hundred;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantations, and specifying the distance of the plants from each other, to be delivered to the Society on or before the first Tuesday in April, 1821.

WALNUTS.

19. To the person who shall invent and discover to the Society an improved mode of propagating the superior varieties of Walnuts, either by budding, grafting, or any other mode, except sowing; —*the Gold Medal.*

Certificates that not fewer than fifty trees have been so raised; with a full account of the method practised, to be produced to the Society on or before the first Tuesday in April, 1821.

SECURING PLANTATIONS.

20. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive method of securing young plantations of timber trees and hedge rows, from hares and rabbits, as well as from sheep and cattle, which at the same time shall be least subject to the depredations of wood-stealers;—*the Silver Medal.*

The accounts, and certificates of the efficacy of the method to be produced to the Society on or before the last Tuesday in March, 1821.

WHEAT.

21. For the best set of experiments made on not less than twelve acres, four acres being sown broad-cast, four drilled, and four dibbled (the two latter in equi-distant rows), in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation and expense of each mode of culture be fully described; and that proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the last Tuesday in February, 1821.

BEANS.

22. To the person who shall discover and cultivate, either by the drill or dibbling method, on not less than five acres, a species of Horse-beans or Tick-beans, that will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the last Tuesday in February, 1821. It is apprehended that if a Bean should be brought into cultivation with the habits of hotspur, or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat.

PARSNIPS.

23. To the person who shall cultivate the greatest quantity of land, not less than five acres, with Parsnips, for the particular purpose of feeding cattle or sheep;—*the Gold Medal.*

Certificates of the quantity of land so cultivated, with a particular account of the nature of the soil and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the Parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the last Tuesday in February, 1821.

GRASS SEEDS.

24. To the person who shall raise the greatest quantity of each or any of the following named grass seeds, viz.—Meadow Fox-tail (alopecurus pratensis), Sweet-scented Vernal-grass (anthoxanthum odoratum), Timothy-grass (phleum pratense), meadow Fescue-grass (festuca pratensis), smooth-stalked Meadow-grass (poa pratensis), rough-stalked Meadow-grass (poa trivialis), rough Cock's-foot (dactylis glomerata), perennial Ray-grass (lollium perenne);—*the Silver Medal.*

It is required that certificates from persons who have viewed them in a proper state to identify that they are one or other of the seeds above-mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first day of March, 1821.

HEMP.

25. The Society, wishing to encourage the growth of Hemp, in every part of the united empire, for the use of the navy, offer to the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the greatest quantity of land in any part of the united empire, not less than fifty acres statute measure in the year 1820, and shall have at the proper season caused to be plucked the summer Hemp (or male Hemp bearing no seed), and continue the winter Hemp (or female Hemp bearing seed) on the ground until the seed is ripe:—*the Gold Medal.*

26. To the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the next greatest quantity of land in any part of the united empire, not less than twenty-five acres, statute measure, in the year 1820, and shall at the proper season cause the same to be plucked as above-mentioned;—*the Silver Medal.*

Certificates of the number of acres, of the distance of the drills, of the plucking of the Hemp, with a general account of the soil, cultivation, and produce, to be delivered to the Society along with fourteen pounds of the Hemp and two quarts of the seed, on or before the last Tuesday in February, 1821.

N. B. The two preceding premiums are continued for one year longer on the same conditions.

POTATOES.

27. To the person who shall, in the year 1821, cultivate the greatest quantity of land, not less than fifty acres, with Potatoes of such qualities as shall be fit for the use of the table in the months of April, May, and June, 1822;—*the Gold Medal*, or *Thirty Guineas.*

Proper certificates, along with other necessary particulars, to be delivered in to the Society on or before the first Tuesday in Nov. 1822.

PRESERVING TURNIPS, CARROTS, PARSNIPS, BEETS, OR MANGEL WORZEL.

28. To the person who shall discover to the Society the best and cheapest method of preserving these roots perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

It is required that a full and accurate account of the method employed, and the expense attending the process, together with certificates that the produce of four acres, at the least, has been preserved according to the method described, and applied to the feeding of sheep and neat cattle; that the whole were drawn out of the ground before the first day of February, in order to clear the greater part of it

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previous to its being prepared for corn, and to save the soil from being exhausted by the turnips or other roots, and also of the weight of an average sixteen perches of the crop; be produced to the Society on or before the last Tuesday in April, 1821.

29. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

PRESERVING CABBAGES.

30. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed Cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

31. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

Conditions the same as for preserving turnips, Art. 28.—And the accounts to be produced on or before the last Tuesday in April, 1821.

MAKING MEADOW-HAY IN WET WEATHER.

32. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of making Meadow-hay in wet weather;—*the Gold Medal.*

A full account of the method employed, and of the expense attending the process, with not less than fifty-six pounds of the Hay; and certificates that at least the produce of six acres of land has been made according to the method described, and that the whole is of equal quality with the sample; to be produced on or before the first Tuesday in February, 1821.

HARVESTING CORN IN WET WEATHER.

33. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of Harvesting Corn in Wet Weather;—*the Gold Medal.*

A full account of the method employed, and of the expense attending the process, with not less than two sheaves of the corn, and certificates that at the least the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples; to be produced on or before the first Tuesday in February, 1821.

GAINING LAND FROM THE SEA.

34. To the person who shall have gained the greatest quantity of Land from the Sea, not less than fifty acres, on the coast of Great Britain or Ireland; —*the Gold Medal.*

Certificates of the quantity of Land, and that the experiments were begun after the first of January, 1815, to be produced to the Society on or before the first Tuesday in February, 1821.

35. The same premium is extended one year farther.

IMPROVING WASTE LAND.

36. For the most satisfactory account of the best method of improving any one of the following soils, being Land lying Waste and uncultivated, viz. clay, gravel, sand, chalk, peat earth, or bog, verified by experiments on not less than fifty acres of land;—*the Gold Medal.*

37. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required, that the Land, before such improvement, be absolutely uncultivated, and in a great measure useless, and that, in its improved state, it be inclosed and cultivated.

Certificates of the number of acres, of the quality of the Land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced on or before the first Tuesday in February, 1821.

MANURES.

38. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following Manures, used as top-dressings on grass and corn land, viz. soot, coal-ashes, wood-ashes, lime, gypsum, bones, night-soil, or any other fit article;—*the Gold Medal.*

It is required that the above experiments be made between two or more

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of the above-mentioned Manures, and that not less than two acres of land be dressed with each Manure.

An account of the nature of the soil, quantity, and expense of the manure and crops, with certificates, to be produced on or before the last Tuesday in February, 1821.

IRRIGATION OF LAND.

39. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land superior to, and cheaper than any other method now in use;—*the Gold Medal*, or *Fifty Guineas.*

A model, on a scale of one inch to a foot, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it was raised, to be produced to the Society on or before the first of March, 1821.

PARING PLOUGH.

40. To the person who shall invent and produce to the Society a Machine or Plough for the purpose of Paring land preparatory to burning, superior to any hitherto known or in use for such purpose, and to be worked by not more than one man and two horses;—*the Silver Medal*, or *Twenty Guineas.*

The machine and certificates that at least ten acres have been pared by it in a proper manner, to be produced to the Society on or before the first of February, 1821.

DIBBLING MACHINE.

41. To the person who shall invent a machine, superior to any hitherto known or in use, to answer the purpose of dibbling wheat, by which the holes for receiving the grain may be made at equal distances and proper depths;—*the Silver Medal and Ten Guineas.*

The Machine with certificates that at least three acres have been dibbled by it, to be produced to the Society on or before the second Tuesday in February, 1821.

THRASHING MACHINE.

42. To the person who shall invent a Machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at a less expense, than by any method now in use;—*the Gold Medal.*

The Machine, or a Model, with proper certificates that such a Machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation, to be produced to the Society on or before the last Tuesday in February, 1821.

DESTROYING THE GRUB OF THE COCKCHAFER.

43. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying the Grub of the Cockchafer, or of preventing or checking the destructive effects which always result from the attack of these insects on corn, peas, beans, and turnips;—*the Gold Medal.*

The accounts, with proper certificates, to be produced on or before the first Tuesday in February, 1821.

DESTROYING WORMS.

44. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying worms, or of preventing the destructive effects they occasion on corn, beans, peas, or other pulse;—*the Silver Medal.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in February, 1821.

DESTROYING THE FLY ON HOPS.

45. To the person who shall discover to the Society an easy and efficacious method of destroying the Fly on Hops, superior to any hitherto known;—*the Gold Medal.*

Accounts and certificates of the method having been successfully practised on not less than four acres of Hop ground; to be delivered to the Society on or before the first Tuesday in February, 1821.

PREVENTING THE BLIGHT ON FRUIT TREES AND CULINARY PLANTS.

46. To the person who shall discover to the Society the most effectual method of preventing the Blight or ravages of

Insects, on Fruit Trees and Culinary Plants, superior to any hitherto known or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

The accounts with proper certificates, to be delivered to the Society on or before the last Tuesday in February, 1821.

FOR SCRAPING THE BARK OFF FRUIT TREES.

47. To the person who shall send to the Society the best account of experiments made by scraping the bark off Fruit Trees, according to the plan recommended by Sir John Sinclair, in his Treatise on the subject;—*the Silver Medal.*

Certificates that the experiments have succeeded, to be sent to the Society on or before the first Tuesday in March, 1821.

CURE OF THE ROT IN SHEEP.

48. To the person who shall discover to the Society the best and most effectual method of curing the Rot in Sheep, verified by repeated and satisfactory experiments;—*the Gold Medal.*

It is expected that the Candidates furnish accurate accounts of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper certificates, must be delivered to the Society on or before the last Tuesday in February, 1821.

CURE OF THE FOOT-ROT IN SHEEP.

49. To the person who shall discover to the Society the best and most effectual method of curing the Foot-rot in sheep;—*the Silver Medal.*

It is required that the cure be ascertained by repeated and satisfactory experiments, and the method of performing it be verified by proper certificates, delivered to the Soeiety on or before the last Tuesday in February, 1821.

PREVENTING THE ILL EFFECTS OF FLIES ON SHEEP.

50. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies;—*the Silver Medal.*

It is required that the method be ascertained by repeated experiments, and that a certificate of its efficacy be delivered to the Society on or before the first Tuesday in February, 1821.

PROTECTING SHEEP.

51. To the person who, in the winter 1820—1821, shall have protected the greatest number of sheep, not fewer than one hundred, by hovels, sheds, or any other means;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society on or before the first Tuesday in March, 1821.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time; together with the general method of managing them.

FEEDING CATTLE.

52. For the best experiments on Stall feeding of Cattle (not fewer than five head), to be continued for the space of twelve months, in order to prove the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain, or Ireland, specifying the nature of the food given, together with the daily consumption of each beast, with its weekly increase in weight, and such other observations as may be deemed of consequence;——*the Gold Medal.*

A full account of the methods employed, and of the expenses attending the same, and certificates of the sundry matters stated, to be produced on or before the second Tuesday in Feb. 1821.

BEES, WAX, AND HONEY.

53. To the person who shall erect, previous to the first day of September, 1820, an apiary, containing the greatest number and heaviest hives or boxes stocked with Bees, not less than one hundred;—*the Silver Medal,* or *Twenty Guineas.*

54. For the next greatest number, not fewer than fifty stocks;—*Ten Guineas.*

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55. For the next greatest number,

not fewer than twenty-five stocks;—*Five Guineas.*

Proper certificates of the number of stocks, and that they have been in the possession of the claimant during the preceding summer, to be produced to the Society on or before the first Tuesday in March, 1821.

It is expected that the claimant will give such particular information on the subject, as may tend to benefit the public, and enable other persons to keep bees to advantage; also that improved methods be made use of in their management.

PREMIUMS

FOR DISCOVERIES AND IMPROVEMENTS IN

CHEMISTRY, DYEING, AND MINERALOGY.

INCREASING STEAM.

56. To the person who shall invent and discover to the Society a method, verified by actual experiments, of increasing the quantity or force of Steam in Steam Engines, with less fuel than has hitherto been employed, provided that in general the whole amount of the expenses in using steam engines may be considerably lessened;—*the Gold Medal,* or *Fifty Guineas.*

To be communicated to the Society on or before the last Tuesday in February 1821.

PREVENTION OF SMOKE.

57. To the person who shall invent and produce to the Society the best and easiest means, superior to any now before the public, of preventing the emission of dense Smoke from the chimnies of steam-engines, breweries, and manufactories;—*the Gold Medal,* or *Fifty Guineas.*

Certificates that the means proposed have been found to succeed in practice, to be produced to the Society on or before the first Tuesday in February, 1821.

COAL GAS.

58. To the person who shall discover the cheapest method of purifying the inflammable gas procured from coal, superior to any method now in use;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process, with certificates of its fully answering the intended purpose, to be produced to the Society on or before the second Tuesday in February, 1821.

PREVENTING THE ILL EFFECTS OF SMELTING ORES.

59. To the person or persons who shall invent and discover to the Society the most effectual method or methods of preventing the ill effects arising to vegetation and animal life, from the sulphureous, arsenical, or other noxious fumes disengaged in smelting the ores of Copper, Zinc, Lead, Tin, Iron, &c. in the large way, and if possible, of converting those pernicious fumes to useful purposes, in a manner superior to any hitherto known or in use;—*the Gold Medal,* or *Fifty Guineas.*

It is required that a full account of the process employed, with certificates of its being successfully carried into effect, be produced to the society on or before the first Tuesday in March, 1821.

FINE BAR IRON.

60. To the person, in Great Britain, who shall make the greatest quantity of Bar-iron, not less than ten tons, with coak, from coak pigs equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal,* or *Fifty Guineas.*

Samples, not less than one quarter of a hundred weight, with certificates that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in March, 1821.

REFINING COPPER FROM THE ORE.

61. To the person who shall discover to the Society a method of separating, purifying, and refining Copper from the Ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than and superior to any hitherto known or in use;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than 14 lbs. of the copper so refined, to be produced to the Society on or before the last Tuesday in February, 1821.

PREPARING BRASS.

62. To the person or persons who shall discover a method of making Brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country, and equal to foreign brass;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured, and a sample of the brass, not less than 14 lbs. to be produced to the Society on or before the last Tuesday in February, 1821.

IMPROVED EARTHENWARE CRUCIBLES.

63. To the person who shall invent and discover to the Society a process for manufacturing earthenware crucibles which shall be capable of enduring higher degrees of heat than those now in use, and shall not be too expensive;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and of the materials employed, with satisfactory certificates of the crucibles having been found to answer in use, and specimens of the crucibles, to be produced to the Society on or before the last Tuesday in March, 1821.

PREPARATION OF SULPHURIC ACID, FROM SULPHUR, WITHOUT THE USE OF ANY NITRIC SALT.

64. To the person who shall prepare the largest quantity (not less than one ton) of Sulphuric Acid from sulphur, without any nitric salt, of a specific gravity not inferior to the best sulphuric acid of commerce;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that not less than the above quantity of such an acid has been prepared, together with a sample, to be produced to the Society on or before the first Tuesday in February, 1821.

PREPARATION OF ANY ALKALINE OR EARTHY NITRATE.

65. To the person who shall prepare, in Great Britain, the largest quantity, not less than one ton, of any earthy or alkaline salt of Nitric Acid, by a method superior to, and as cheap as those hitherto practised;—*the Gold Medal*, or *One Hundred Guineas.*

Certificates of the above quantity having been prepared, and a sample of not less than 28 lbs. to be produced to the Society on or before the last Tuesday in February, 1821.

GLAZING COMMON EARTHENWARE WITHOUT LEAD OR ARSENIC.

66. To the person who shall discover to the Society, the cheapest, safest, most durable, and most easily fusible, composition, fit for the purpose of glazing common Earthenware, without any preparation of lead, arsenic, or other pernicious ingredients, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

Specimens of the ware so glazed, with proper certificates of its having succeeded, and a sample of the materials made use of, to be produced to the Society on or before the first Tuesday in February, 1821.

CROWN GLASS.

67. To the person or persons who shall make Crown or Window Glass equally transparent, and as free from blue and green colour as the best German sheet;—*the Gold Isis Medal*, or *Thirty Guineas.*

Certificates that not less than two cwt. has been made, together with one whole plate and two of the largest squares that can be cut, and a full

account of the proportions of the ingredients and of the process of manufacture, to be produced to the Society on or before the last Tuesday in February, 1821.

FLINT GLASS.

68. To the person or persons who shall make flint glass free from veins, and as dense and transparent as the best now in use, and quite fit for the purposes of Opticians;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, with certificates that not less than two cwt. has been made, together with 20 lbs. in plates not less than six inches wide, and three quarters of an inch thick, to be produced to the Society on or before the last Tuesday in January, 1821.

DYEING SILK OR WOOLLEN.

69. To the person who shall discover a method of dyeing Silk or Woollen, of any colour, superior to the same produced by other British dyers, and equal to those produced by the Continental dyers;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk and woollen in its undyed and dyed state, to be produced to the Society on or before the first Tuesday in March, 1821.

DYING WITH LAC LAKE.

70. To the person who shall invent and discover to the Society a process for dying silk, wool or cotton with lac lake, superior to any now in use;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, with certificates that it has been found to answer completely in use, and specimens of articles so dyed, to be produced to the Society on or before the last Tuesday in March, 1821.

IMPROVED BLACK DYE FOR SILK OR WOOL.

71. To the person who shall invent and discover to the Society a black dye for silk or wool superior in colour and durability to any at present in use;—*the Gold Medal*, or *Fifty Guineas*.

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk or wool so dyed, to be produced to the Society, on or before the last Tuesday in March, 1821.

PREPARATION OF A RED STAIN FOR COTTON CLOTH.

72. To the person who shall communicate to the Society the most effectual method of printing or staining cotton cloths with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal*, or *Fifty Guineas*.

Certificates that the above process, has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, one pound of the colour, and a full account of the preparation and application, to be produced to the Society on or before the second Tuesday in February, 1821.

PREPARATION OF A GREEN COLOUR FOR PRINTING COTTON CLOTH.

73. To the person who shall communicate to the Society the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions of indigo;—*the Gold Medal*, or *Fifty Guineas*.

Certificates and conditions as for Premium 72.

BRITISH INDIGO.

74. To the person who shall prepare Indigo, or a substance equal to it, from any plants (except woad), the growth of Great Britain or Ireland, at a price not greater than that of foreign indigo of equal quality;—*the Gold Medal*, or *Fifty Guineas*.

A full account of the process and ingredients employed, together with their proportions, and satisfactory certificates that at least one cwt. of the indigo has actually been prepared; also

a sample of the same weighing not less than 7 lbs. to be produced to the Society on or before the last Tuesday in Feb. 1821.

SUBSTITUTE FOR THE BASIS OF WHITE PAINT.

75. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of white paint, equally proper for the purpose as the white lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white-lead;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than 25 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in February, 1821.

PERMANENT WHITE PAINT FOR THE USE OF ARTISTS.

76. To the person who shall produce to the Society a White Paint for oil, superior to any hitherto known, and which is not liable to be discoloured by exposure to light or to sulphuretted hydrogen gas;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and 1lb. of the colour to be produced to the Society, on or before the second Tuesday in February, 1821.

RED PIGMENT.

77. To the person who shall discover to the Society a full and satisfactory process for preparing a Red Pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal*, or *Fifty Guineas.*

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1821.

N. B. It is required that the colour should remain unaltered by the common exposure to strong light, damps, and noxious vapours.

ULTRAMARINE.

78. To the person who shall prepare an artificial Ultramarine, equal in colour, brilliancy, and durability, to the best prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal*, or *Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

COLOURLESS LAC VARNISH.

79. To the person who shall produce to the Society a Lac Varnish equally hard with that made from shell or seed lac, and as fit for use in the arts, but deprived of its colouring matter;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and one quart of the varnish to be produced to the Society on or before the second Tuesday in January, 1821.

A SUBSTITUTE FOR LEAD PIPES.

80. To the person who shall invent and produce to the Society, a Substitute for the Lead Pipes used for conveying malt and other liquors from the cellars to the bars of public houses;—*the Gold Medal*, or *Fifty Guineas.*

The substance of which the Pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and of a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society on or before the last Tuesday in February, 1821.

SUBSTITUTE FOR TAR.

81. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of the United Kingdom, or its colonies;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than one hundred weight, with certificates that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an account of the process, to be deli-

vered to the Society on or before the first Tuesday in March, 1821.

N. B.—Considerable quantities of tar are produced in Sweden and Norway from the roots of fir trees burnt for that purpose.

TURPENTINE FROM THE SCOTCH FIR, OR PINUS SYLVESTRIS.

82. For the greatest quantity of Turpentine, not less than two hundred weight, prepared in Great Britain, from that species of fir called the Scotch fir, or Pinus sylvestris, Linn.;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the Turpentine being prepared from such trees of British growth, together with fifty-six pounds of the Turpentine, to be delivered to the Society on or before the second Tuesday in March, 1821.

83. For the next greatest quantity prepared, not less than one hundred weight, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

N. B. The Society being in possession of the method practised for extracting Turpentine from trees whilst growing, and of samples so procured, information will be given upon that subject, on application for that purpose, at the Society's house.

PREPARATION OF TAN.

84. To the person who shall prepare in the most concentrated form, so as to be easily portable, and at a price applicable to the purposes of manufacturers, the largest quantity, not less than one hundred weight, of the astringent principle called Tannin, which abounds in oak bark, and many other vegetable substances;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the superior quality of the quantity so prepared, and a sample of not less than 28 lbs. to be produced to the Society on or before the last Tuesday in February, 1821.

PRESERVING SEEDS OF VEGETABLES.

85. For the best method of preserving Seeds of Plants in a state fit for vegetation a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the last Tuesday in December, 1821;—*the Gold Medal*, or *Thirty Guineas.*

PRESERVING SALTED PROVISIONS FROM BECOMING RANCID OR RUSTY.

86. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving Salted Provisions from becoming rancid or rusty;—*the Gold Medal*, or *Thirty Guineas.*

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the last Tuesday in February, 1821.

PRESERVING IRON FROM RUST.

87. To the person who shall invent and discover to the Society a cheap composition superior to any now in use, which shall effectually preserve Wrought Iron from rust;—*the Gold Medal*, or *Fifty Guineas.*

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with ten pounds weight of the composition, on or before the last Tuesday in January, 1821.

PREVENTING THE DRY-ROT IN TIMBER.

88. To the person who shall discover to the Society a certain method of preventing the Dry Rot in Timber, superior to any hitherto known;—*the Gold Medal*, or *Thirty Guineas.*

The accounts of the cause and method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the last Tuesday in February, 1821.

Note.—For a method of curing and preventing the dry-rot in ship timber see Mr. Bowden's communication in Vol. 36 of the Society's Transactions.

DESTRUCTIVE EFFECTS FROM MOTHS.

89. To the person who shall discover

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to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by Moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal*, or *Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in January, 1821.

RENDERING LEATHER WATER PROOF.

90. To the person who shall discover a method, superior to any now in use, and of moderate price, of rendering Leather Water-proof, without injuring its texture or pliability;—*the Silver Medal*, or *Fifteen Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the leather in its unprepared and prepared state, to be produced to the Society on or before the last Tuesday in February, 1821.

REFINING WHALE OR SEAL OIL.

91. For disclosing to the Society an effectual method of purifying Whale or Seal Oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; provided that such purified oil resists congelation in an equal degree with the unpurified;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society to determine the validity of the claim; and certificates that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil in its unpurified state, and two gallons so refined, to be produced to the Society on or before the second Tuesday in February, 1821.

MANUFACTURING TALLOW CANDLES.

92. To the person who shall discover to the Society a method of hardening or otherwise preparing Tallow, so that candles may be made of it which will burn as clear and with as small a wick as wax candles, without running, and may be afforded at a less expense than any at present made with spermaceti;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that 112 lbs. of such tallow have been made into candles, and 12 lbs. of the candles made thereof, to be produced to the Society on or before the second Tuesday in February, 1821.

INDELIBLE INK.

93. To the person who shall discover to the Society a method of making a Black Ink proper for writing, superior to any at present known, indestructible by chemical applications, and not dearer than that which is now in common use;—*The Silver Medal*, or *Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities above-mentioned, with a full detail of the process of making it, and two quarts of the ink, to be delivered to the Society on or before the second Tuesday in February, 1821.

PRINTERS' INK.

94. To the person who shall invent and discover to the Society the best composition for Printers' Ink, superior to any hitherto known or in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that 112 lbs. of such ink have been made, with a full account of the process employed, and 6lbs. of the ink, to be produced to the Society on or before the last Tuesday in February, 1821.

COPPER PLATE PRINTERS' INK.

95. To the person or persons who shall invent and discover to the Society the best composition, superior to any hitherto known or in use, and fit for the finest kind of copper-plate printing;—*the Gold Medal*, or *Thirty Guineas.*

Certificates and conditions the same as for the last premium.

SUPERIOR OIL FOR CHRONOMETERS AND WATCHES.

96. To the person who shall invent and discover to the Society the best

method of distinguishing the kind of oil fittest for chronometers and watches, ascertained by actual experiments; or for a superior method of rendering oil more fit for the above purpose than any hitherto in use, and particularly in rendering it less liable to become thick or rancid;—*the Gold Medal*, or *Fifty Guineas.*

A full account of the experiments and of the process or processes employed, verified by satisfactory certificates, together with a specimen of the oil, to be produced to the Society on or before the last Tuesday in March, 1821.

STATUARY MARBLE.

97. To the person who shall discover within Great Britain or Ireland, a quarry of White Marble fit for the purposes of statuary, and equal to those kinds now imported from Italy;—*the Gold Medal*, or *One Hundred Guineas.*

A block of at least three feet in length, two in height, and two in width, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the first Tuesday in February, 1821.

N. B. In order to prevent useless expense or trouble to the Claimant in forwarding so large a block, the Society will be ready to examine any smaller specimen of the marble and express their opinion of its value to the Candidate before the block required by the above premium is produced.

STONE FOR LITHOGRAPHY.

98. To the person who shall discover within Great Britain or Ireland, a quarry of stone fit for the purposes of Lithography, equal at least to the stones imported from abroad;—*the Gold Isis Medal*, or *Thirty Guineas.*

A specimen of the stone at least two feet square and two inches in thickness, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the last Tuesday in February, 1821.

MINERALOGICAL COUNTY MAPS.

99. To the person who shall complete and publish the best Mineralogical Map of any County in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced, with sections of the strata;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the accuracy of such maps, together with the maps, to be produced to the Society on or before the first Tuesday in February, 1821. The maps to remain the property of the Society.

MINERALOGICAL MAP OF IRELAND.

100. To the person who shall complete and publish an accurate Mineralogical Map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal*, or *Fifty Guineas.*

MINERALOGICAL MAP OF SCOTLAND.

101. The same premium is offered for a Mineralogical Map of Scotland, on similar conditions.

NATURAL HISTORY.

102. To the author who shall publish in the year 1820, the Natural History of any county in the United Kingdom;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the several natural productions, animal, vegetable, and mineral, peculiar to the county, or found therein, be carefully and scientifically arranged and described, in order that the public may be enabled to judge what arts or manufactures are most likely to succeed in such county. A copy of the work to be delivered to the Society on or before the last Tuesday in February, 1821, to remain the property of the Society.

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PREMIUMS IN POLITE ARTS.

HONORARY PREMIUMS FOR NOBILITY.

103. For the best Original Painting or Drawing of any kind, by gentlemen under the age of twenty-one, sons or grandsons of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

104. For the best Copy on similar conditions;—*the Silver Medal.*

105. For the best Original Painting or Drawing of any kind, by ladies under the age of twenty-one; daughters or grand-daughters of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

106. For the best Copy on similar conditions;—*the Silver Medal.*

HONORARY PREMIUMS FOR GENTLEMEN OR LADIES.

107. For the best Original Painting in oil colours by gentlemen under the age of twenty-five;—*the Gold Medal.*

108. For the best Copy in oil colours by gentlemen under the age of twenty-one;—*the Silver Medal.*

109. For the best Original Drawing or Painting in water colours by gentlemen under the age of twenty-five;—*the Gold Medal.*

110. For the best Copy in water colours by gentlemen under the age of twenty-one;—*the Silver Medal.*

111. For the best Original Painting in oil colours by ladies under the age of twenty-five;—*the Gold Medal.*

112. For the best Copy in oil colours by ladies under the age of twenty-one;—*the Silver Medal.*

113. For the best Original Drawing, or Painting in water-colours, by ladies under the age of twenty-five;—*the Gold Medal.*

114. For the best Copy in water-colours, by ladies under the age of twenty-one;—*the Silver Medal.*

N. B. As the foregoing honorary premiums are intended only for the nobility and gentry; persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admitted candidates in the above classes.

PREMIUMS FOR ARTISTS AND OTHERS.

115. For the best Historical Painting in oil colours, by gentlemen under the age of twenty-five; the subject, Satan resuming his form when touched by the spear of Ithuriel (see Milton's Paradise Lost);—*the Gold Medal.*

116. For the best Historical Painting in oil colours by ladies under the age of twenty-five;—*the Gold Medal.*

117. For the best Historical Drawing by gentlemen under the age of twenty-five;—*the Gold Isis Medal.*

118. For the best Historical Drawing by ladies under the age of twenty-five;—*the Gold Isis Medal.*

119. For the best Copy in oil colours, of an Historical Painting, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

120. For the best Historical Drawing, being a Copy, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

For the next in merit on similar conditions;—*the Silver Isis Medal.*

121. For the best Original Landscape, in oil, by persons of either sex, under the age of twenty-five;—*the Gold Isis Medal.*

122. For the best Original Landscape in water colours, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

123. For the best Copy of a Landscape in oil or water colours, by persons of either sex, under the age of eighteen;—*the Silver Isis Medal.*

124. For the best Original Painting or Drawing of fruit or flowers, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

125. For the best Original Painting or Drawing, not mentioned in any of the foregoing premiums, by persons of either sex under the age of twenty-five;—*the Gold Medal.*

126. For the best Copy, not mentioned in the foregoing premiums, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

DRAWINGS FROM SCULPTURE.

127. For the best finished Drawing of the Ilissus of the Elgin collection in the

British Museum; the size of the figure not less than two feet high, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

128. For the best finished Drawing of the statue of Libera, No. 52, in the 6th room of the British Museum (the size of the figure not less than two feet), by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

129. For the best finished Drawing of an Homeric hero, marked No. 23, room 3, in the British Museum, not less than twelve inches in height, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

N. B. Those persons who intend to become candidates for the premiums offered for Drawings, from subjects in the British Museum, may be informed by the Secretary, of the proper way of applying to the Trustees of the Museum for permission for that purpose.

130. For the best Outline, after the plaster cast of the Laocoon, by persons of either sex, under the age of twenty-one, the size of the figure not less than two feet;—*the Silver Medal.*

PERSPECTIVE DRAWINGS.

131. For the best Perspective Drawing of machinery, by persons of either sex, under the age of twenty-one;—*the Silver Medal.*

ARCHITECTURAL DESIGNS.

132. For the best Original Design for a building suitable to the purposes of the Society for the Encouragement of Arts, Manufactures, and Commerce, consisting of plan, elevation, section, and perspective view, to the scale of $\frac{1}{12}$th of an inch to a foot; the drawings to remain the property of the Society if required;—*the Gold Medallion.*

For the next in merit;—*the Silver Medallion.*

The following inscription to be engraved on these *Medallions*; "The Premium given by the Society for the Encouragement of Arts, Manufactures, and Commerce, in conformity to the Will of John Stock, esq. of Hampstead."

MODELS.

133. For the best Original Model of a group, by persons under the age of twenty-five;—*the Gold Medal.*

For the next in merit;—*the Gold Isis Medal.*

134. For a single figure by persons under the age of twenty-one;—*the Silver Medal.*

135. For the best restored Model of the Ilissus in the Elgin collection, not less than three feet in length;—*the Gold Isis Medal.*

*** The Model to be baked or cast in plaster, and a cast from the Model in each case to remain the property of the Society if required.

ANATOMICAL MODELS.

136. For the best original anatomical model in wax;—*the Gold Medal.*

The Society in calling the attention of the public to the subject of anatomical modelling, beg leave to refer to the beautiful specimens of this art at the Royal College of Surgeons.

ETCHING OF AN HISTORICAL SUBJECT.

137. For the best free Etching in historical composition, from a picture of eminence;—*the Gold Isis Medal.*

ETCHING OF A LANDSCAPE.

138. For the best free Etching in Landscape composition, from a picture of eminence;—*the Silver Medal.*

HISTORICAL ENGRAVINGS.

139. For the best finished Engraving in historical composition;—*the Gold Medal.*

LANDSCAPE ENGRAVING.

140. For the best finished Engraving in Landscape composition;—*the Gold Isis Medal.*

ENGRAVING OF A PORTRAIT.

141. For the best finished Engraving of a Portrait;—*the Gold Isis Medal.*

N. B. In the class of finished Engravings the Society requires an aqua-fortis impression, and a finished proof to be sent, and to remain with the Society.

ENGRAVING ON STEEL.

142. For the best specimen of engraving on a steel plate not less than 5 inches by 3 inches in area, and not exceeding

¼th of an inch in thickness; the plate to be afterwards hardened without injuring the engraving;—*the Gold Medal.*

The Plate, with two impressions from it, both in its soft and hardened state, to be produced to the Society. The impressions, but not the plate, to remain the property of the Society.

ENGRAVINGS ON WOOD OR METAL BLOCKS.

143. For the best Engraving on Wood or Metal Blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the Block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the Block, to be produced to the Society. The impressions, but not the Block, to remain the property of the Society.

N. B. An impression from a block, the subject of which has been recently drawn and etched with aqua-fortis on copper is deposited with the Society for the inspection of artists and others.

LITHOGRAPHY.

144. For the best specimen in this art;—*the Gold Isis Medal.*

A particular account of the process employed, with six impressions of the drawing, to be produced to the Society.

MEDAL DIE ENGRAVING.

145. For the best Die Engraving either of a single figure or group, after the engraver's own design and model;—*the Gold Medal.*

146. For the best Die Engraving of a head;—*the Gold Isis Medal.*

The Dies, with two impressions or casts, and the model, in each claim for Medal Die sinking, are to be produced to the Society, and the impressions or casts to remain the property of the Society.

CONDITIONS FOR THE POLITE ARTS.

All articles in the class of Polite Arts, whether for claims or bounties, are to be produced to the Society on or before the first Tuesday in March, 1821, and none can be received after that day.

No Candidate, under any pretence whatever, shall be allowed to retouch or varnish a performance after it has been received by the Society.

No person having received a premium or bounty, shall afterwards receive an equal or inferior one in the same department of art.

No Candidate shall receive more than one premium or bounty in one year.

No more than one performance in each class shall be received from the same Candidate.

All performances to which premiums or bounties are adjudged shall remain with the Society until after the second Wednesday in June, 1821, when they will be re-delivered, unless mentioned in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the claimant affix to his performance whatever mark he pleases, and that the same mark be inscribed on a paper sealed up, containing within, the name and residence of the Candidate, and *on the outside* the age and sex, and the number of the premium in claim of which the performance is offered; the name not to be disclosed unless the Candidate be successful, or in consequence of a special vote of the Society, or Committee. No production can be received with a view to obtain a bounty, which could have come into any of the foregoing classes.

To encourage real merit, and to prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the Candidate, the Society require a specimen of the abilities of each successful Candidate, to be made under the inspection of the Committee of Polite Arts.

All Candidates in the Polite Arts are required to signify, on their drawings, whether the performances are originals or copies; and if possible to send the originals from which the copies are taken.

All copies of drawings, &c. are to be on a different scale from the original.

The Society reserve to themselves the power of giving a Medal of less value than the premium offered, or of withholding the same altogether, in cases where the performance shall be deemed undeserving of reward.

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PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

CLOTH FROM HOP STALKS, NETTLES, &c.

147. To the person who shall produce to the Society the greatest quantity, not less than thirty yards, of cloth, at least 27 inches wide, made in Great Britain or Ireland, of Hop Stalks or Bines, Nettles, or other raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as cloth of equal quality and appearance now made from hemp, flax, or cotton, and much finer in quality than any hitherto manufactured in England from Hop Stalks, &c.;—*the Gold Medal*, or *Thirty Guineas.*

One pound of the thread of which the Cloth is made, and thirty yards of the Cloth, together with proper certificates that the whole is manufactured from Hop Stalks, or Bines, &c. to be produced to the Society on or before the last Tuesday in February, 1821.

N. B. The Society is already in the possession of Cloth made in England from Hop Stalks or Bines, and Nettles, which may be inspected by application to the house-keeper.

SHEEP'S WOOL.

148. To the person who shall prove to the Society, that he has sold the largest quantity of Merino Wool, or such Wool as will answer the same purpose, being the produce of his own flock, in the United Kingdom, for the purpose of being manufactured into superfine cloth, the quantity of Wool not less than five hundred weight, in the year 1820;—*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it to be produced to the Society on or before the last Tuesday in March, 1821.

149. For the next greatest quantity, not less than two hundred and fifty pounds;—*the Silver Medal*, on similar conditions.

WICKS FOR CANDLES OR LAMPS.

150. To the person who shall discover to the Society, a method of manufacturing Hop-stalks or Bines, Nettles, or any other cheap material, the growth of the United Kingdom, so as to render them equally fit for the purpose of supplying the place of cotton, for Wicks of Candles or Lamps;—*the Silver Medal* or *Twenty Guineas.*

Samples, not less than 5 lbs. weight, of the Wicks so prepared, to be produced to the Society on or before the last Tuesday in February, 1821, with certificates that the whole quantity is equal in quality to the sample.

WICKS FOR CANDLES.

151. To the person who shall make known to the Society the most satisfactory result of a series of experiments actually made by him to determine the best thickness of Cotton Wicks for Candles, so as to obviate the defects of those commonly used;—*the Silver Medal* or *Ten Guineas.*

Certificates that not less than one hundred weight have been so made, and six pounds of the Candles, to be produced to the Society, on or before the last Tuesday in February, 1821.

N. B. The intention in offering this premium is, to ascertain the proper thickness or bulk of the Wick in proportion to that of the tallow, and to remove the unpleasant consequences and waste arising from the sparkling, or guttering of the candles in common use.

PAPER FROM RAW-VEGETABLE SUBSTANCES.

152. To the person who shall, between the first of January, 1820, and the first of January, 1821, make the greatest quantity, and of the best quality (not less than ten reams) of good and useful paper, from raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as paper of equal quality and appearance now made from rags;—*the Silver Medal* or *Twenty Guineas.*

N. B. The object of the Society being

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to add to the number and quantity of raw materials used in this manufacture, it is their wish to include every useful sort of paper, and to introduce such natural products as can be easily and cheaply procured in great quantities. The Society are in possession of two volumes containing a great variety of specimens of paper made from raw vegetable substances, viz. nettles, potato-haulm, hop-bines, &c. which volumes may be inspected by any person on application to the Housekeeper.

Certificates of the making such paper, and one ream of the paper to be produced on or before the second Tuesday in February, 1821.

TRANSPARENT PAPER.

153. To the person who shall discover to the Society a method of making Paper from the pulp, that shall be perfectly transparent, and of a substance and body equal to foolscap, that shall take and bear common writing-ink with the same facility and correctness as Writing paper generally in use;—*the Silver Medal*, or *Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced on or before the second Tuesday in March, 1821.

(INDIA PAPER, see page xxxi.)

CHINTZ PATTERNS FOR CALICO PRINTERS.

154. For the best original pattern in a new taste, of light and dark-ground Chintz for garment work, or furniture, fit for the purpose of Calico-printers;—*the Silver Medal.*

To be produced to the Society on or before the first Tuesday in March, 1821, and a copy of the pattern for which the premium is adjudged, to remain the property of the Society.

COPPER-PLATE PATTERNS.

155. For the best pattern, in a new style, fit for the purpose of calico-printers for garment-work or furniture;—*the Silver Medal.*

To be produced to the Society on or before the first Tuesday in March, 1821, and a Copy of the pattern for which the premium is adjudged, to remain the property of the Society.

GLOVES.

156. To the person who shall make known to the Society a process equal or superior to that of the French, for preparing, dying, and finishing the skins, verified by actual experiments, and the communication accompanied with at least a dozen pair of gloves made from skins so prepared;—*the Gold Medal*, or *Forty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society on or before the last Tuesday in March, 1821.

CAT-GUT.

157. To the person who shall discover to the Society the best method of manufacturing, in the United Kingdom of Great Britain and Ireland, the intestines of sheep, lambs, goats, or of any other animals, into the article called Cat-gut, equally strong, clear, smooth, even, and free from knots, as the best Italian strings, and at a price not exceeding what they are usually sold for in England;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that not less than fifty pound weight have been so prepared by the claimant, with a full detail of the process, and samples of the articles of various thicknesses, to be produced to the Society on or before the first Tuesday in February, 1821.

158. For the next greatest quantity, not less than twenty-five pounds;—*the Silver Medal*, or *Twenty Guineas*, on similar conditions.

HOSE FOR FIRE ENGINES, BREW-HOUSES, &c.

159. To the person who shall invent and make known to the Society a method of making Hose for Fire Engines, Brewhouses, &c. similar to those used on the continent, made of flax or hemp, or other flexible material cheaper than leather;—*the Gold Isis Medal*, or *Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of

its efficacy in practice, to be produced to the Society on or before the last Tuesday in February, 1821.

THREAD FOR LACE.

160. To the person who shall invent or discover a method of manufacturing Thread from flax, of as fine quality as any used on the Continent;—*the Gold Medal*, or *Thirty Guineas.*

Samples of the Thread, not less than one pound in weight, and of the Lace made therefrom, together with certificates that not less than ten pounds in weight of each sort has been manufactured, to be produced to the Society, on or before the last Tuesday in March, 1821.

PREMIUMS IN MECHANICS.

GUNPOWDER MILLS.

161. To the person who shall invent and bring to perfection the most effectual method of so conducting the works of Gunpowder Mills in the business of making Gunpowder, as to prevent explosion;—*the Gold Medal*, or *One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more Gunpowder Mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1821.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of Gunpowder-making which fall short of the total prevention of explosion; such bounty or reward will be bestowed on them as they may appear to merit.

FAMILY MILL.

162. To the person who shall invent and produce to the Society, a mill for Grinding Corn for the use of private families, or parish poor; the construction to be simple, the mill to be easily worked, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

The Mill, and certificates of its having been used to good effect, to be produced to the Society, on or before the last Tuesday in February, 1821. Cheapness and simplicity will be considered as essential parts of its merit; and the Mill, or a model, to remain with the Society.

A PORTABLE MILL FOR GRINDING CORN.

163. To the person who shall invent and produce to the Society a Portable Corn Mill, superior to any now in use;—*the Gold Vulcan Medal*, or *Thirty Guineas.*

The Mill, and certificates of its efficacy from actual use, to be produced to the Society on or before the last Tuesday in February, 1821.

A PORTABLE OVEN.

164. To the person who shall invent and produce to the Society a Portable Oven, superior to any hitherto in use;—*the Silver Medal*, or *Twenty Guineas.*

The Oven, with certificates that it has been found to answer in use, to be produced to the Society, on or before the last Tuesday in February, 1821.

MACHINE FOR RAISING COALS, ORE, &c. &c.

165. To the person who shall invent a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use; and which shall produce the effect at less expense;—*the Gold Medal*, or *Fifty Guineas.*

A model with a certificate that a machine at large on the same construction has been advantageously used, to be produced to the Society on or before the second Tuesday in February, 1821.

IMPROVED WALKING-WHEEL OR CRANE.

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166. To the person who shall invent

an improved Walking Wheel or Crane, on which the weight or power of any person or persons shall be applied with the greatest safety and effect, and so contrived that the power can be varied according to the greater or less weight to be raised or lowered;—*the Gold Medal*, or *Thirty Guineas.*

A model, with a certificate that the machine at large has been employed to good effect, to be produced to the Society on or before the second Tuesday in March, 1821.

MACHINE FOR RAISING WATER.

167. To the person who shall invent a machine on a better, cheaper, and more simple construction than any hitherto known or in use for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, to be produced to the Society, on or before the last Tuesday in February, 1821.

EXTINGUISHING FIRES.

168. To the person who shall produce to the Society the best and most effectual method of procuring an immediate supply of water in case of Fire, or who shall communicate the best means, superior to any now in use, for preventing or extinguishing accidental Fires in buildings; —*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in January, 1821.

BORING AND BLASTING ROCKS.

169. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of Boring or Blasting Rocks in mines, shafts, wells, &c.;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the first Tuesday in February, 1821.

HEATING ROOMS FOR THE PURPOSE OF MANUFACTURERS.

170. To the person who shall invent and discover to the Society, a method of Heating Rooms, superior to and cheaper than any hitherto known or in use, for the purpose of manufacturers;—*the Gold Medal*, or *Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society on or before the last Tuesday in March, 1821.

IMPROVED VENTILATION.

171. To the person who shall invent and produce to the Society a mode of permanently Ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used;—*the Gold Medal*, or *Fifty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates to be delivered to the Society on or before the last Tuesday in February, 1821.

VENTILATING COAL MINES.

172. To the person who shall invent and carry into practice a method of ventilating coal mines so as effectually to prevent the accidents liable to arise from the accumulation of carburetted hydrogen and other gases;—*the Gold Medal.*

A full account of the process, with certificates of its efficacy, to be produced to the Society on or before the last Tuesday in February, 1821.

N. B. The Society will be very glad to attend to any communication, which, though not completely effecting the object, appears to offer an approximation to it. The Society wish particularly to refer candidates for this premium to the communication made by Mr. Ryan and published in the 34th vol. of the "Transactions," and will consider themselves obliged to any person who will furnish any information with respect to the attempts which have been made to introduce Mr. Ryan's mode of ventilating coal mines into actual use, and of the success with which this method has been attended.

PREVENTING ACCIDENTS FROM STAGE COACHES.

173. To the person who shall invent

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and discover to the Society a method or methods for preventing accidents arising from Stage Coaches; *the Gold Medal*, or *Thirty Guineas.*

Ample certificates of its efficacy, and a description of the method with models of the machinery used, to be produced to the Society on or before the last Tuesday in February, 1821.

N. B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not in some degree be prevented, by an alteration in the manner of placing the luggage.

PREVENTING ACCIDENTS FROM HORSES FALLING WITH TWO WHEELED CARRIAGES.

174. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, to prevent accidents from the falling of Horses with Two-wheeled Carriages, especially on steep declivities;—*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates that the same has been used with success, to be delivered to the Society, on or before the second Tuesday in February, 1821.

IMPROVING TURNPIKE AND OTHER ROADS.

175. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiments, of combining the materials ordinarily employed in making or repairing Roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat, or any other mode, so as to form an even, hard, and durable carriage-road;—*the Gold Medal*, or *Thirty Guineas.*

It is required that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society on or before the first Tuesday in March, 1821.

RAISING THE BODIES OF PERSONS WHO HAVE SUNK UNDER WATER.

176. To the person who shall invent and produce to the Society, a cheap and Portable Drag, or other machine, superior to those now in use, for the purpose of taking up, in the best and most expeditious manner, and with the least injury, the bodies of persons who have sunk under water;—*the Gold Medal*, or *Thirty Guineas.*

The drag or machine, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in March, 1821.

PREVENTING PREJUDICIAL EFFECTS TO THE PERSONS EMPLOYED IN POINTING NEEDLES.

177. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of Pointing Needles, by grinding them dry, during which the particles of grindstone-dust, and steel, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society on or before the second Tuesday in March, 1821.

PREVENTING EXPLOSIONS IN STEAM-ENGINE AND OTHER COVERED BOILERS.

178. To the person who shall invent and discover to the Society a method of rendering covered boilers used for steam engines and other purposes, safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal, and not less than Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society, on or before the last Tuesday in February, 1821.

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AN ORIGINAL SCREW.

179. To the person who shall invent and make known to the Society any mode of producing an original screw more perfect than any hitherto known; —*the Gold Medal*, or *Thirty Guineas.*

A model, or complete drawing and description of the method, with a screw not less than twelve inches in length, to be produced to the Society on or before the last Tuesday in February, 1821.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE.

TAKING WHALES BY THE GUN-HARPOON.

180. To the person who shall strike and take the greatest number of Whales, not fewer than three, with the Gun-harpoon;—*Ten Guineas.*

Certificates of the striking such Whales, and that they were actually taken in the year 1819, signed by the master, or by the mate when the claim is made by the master, to be produced to the Society on or before the last Tuesday in December, 1820.

TAKING PORPOISES.

181. To the people in any boat or vessel, who, in the year 1820, shall take the greatest number of Porpoises, not fewer than thirty, on the coast of Great Britain or Ireland, by gun-harpoon, or any other method, for the purpose of extracting oil from them;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the number, signed by the persons to whom they have been sold or delivered for the purpose of extracting the oil, to be produced to the Society on or before the last Tuesday in February, 1821.

OIL FROM PORPOISES, OR SUN FISH.

182. To the person who shall manufacture the greatest quantity of Oil from Porpoises or Sunfish taken on the coast of Great Britain or Ireland, in the year 1820, not less than twenty tons;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the oil having been made from porpoises or sunfish actually caught on the coast of Great Britain or Ireland, and two gallons of the oil as a sample, to be produced to the Society on or before the last Tuesday in February, 1821.

CURING HERRINGS.

183. To the person who shall send to the Society the best sample of White Herrings (not less than a sixteen gallon barrel) with certificates that not less than thirty barrels, equal in all respects to the sample, have been cured in a British or Irish vessel or port, by the person by whom the sample has been sent to the Society;—*the Gold Medal*, or *Fifty Guineas.*

Samples to be produced to the Society, on or before the first Tuesday in January, 1821, with certificates that the conditions of the premium have been fulfilled; together with a full description of the process employed.

In the 37th and 38th volumes of the Transactions, will be found valuable communications from Mr. Denovan of Leith on the cure of British herrings, to which the Society particularly wish to direct the attention of such persons as intend to claim this premium.

EXPORTING BRITISH-CURED HERRINGS.

184. To the person who shall import into the Hamburgh or other continental market previous to February, 1821, the greatest quantity of white herrings cured in British or Irish vessels, not less than 1,000 barrels, in quality at least equal to the best Dutch herrings, and which in the Hamburgh or other continental market shall produce prices at least equal to the best Dutch;—*the Gold Medal*, or *Fifty Guineas.*

185. For the next greatest quantity, not less than 300 barrels;—*the Gold Isis Medal*, or *Thirty Guineas.*

Proper certificates, and samples of the herrings to be produced to the Society on or before the last Tuesday in February, 1821.

The same premiums to be continued one year longer on similar conditions.

CURING MACKAREL.

186. To the person or persons who shall, before January, 1821, cure the greatest quantity of Mackarel, not less in number than ten thousand, in the best manner and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal*, or *Twenty-five Guineas.*

187. For the next greatest quantity, not less than five thousand;—*the Silver Medal*, or *Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society on or before the first Tuesday in January, 1821, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums to be extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH COLONIES.

NUTMEGS.

188. For the greatest quantity of Merchantable Nutmegs, not less than ten pounds weight, being the growth of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or of the several islands adjacent thereto, and equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas.*

Satisfactory certificates, from the governor or commander in chief, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, to be produced on or before the first Tuesday in January, 1822.

The same premium is offered for the years 1823 and 1824.

KALI FOR BARILLA.

189. To the person who shall have cultivated, in the Bahama islands, or any other part of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, in the year 1820, the greatest quantity of land, not less than two acres, with Spanish Kali fit for the purpose of making Barilla;—*the Gold Medal*, or *Thirty Guineas.*

190. For the next greatest quantity, not less than one acre;—*the Silver Medal*, or *Fifteen Guineas.*

Certificates signed by the governor or commander in chief for the time being, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in February, 1821.

The same premiums, on similar conditions, will be given for Barilla grown in 1821 and 1822.

DESTROYING THE INSECT COMMONLY CALLED THE BORER.

191. To the person who shall communicate to the Society an effectual method of destroying the insect commonly called the Borer, which has of late years been so destructive to the sugar canes in the West India islands;—*the Gold Medal*, or *Fifty Guineas.*

The discovery to be ascertained by satisfactory certificates, under the hand and seal of the governor or commander in chief for the time being, and of some other respectable persons, inha-

bitants of the islands, or other place, in which the remedy has been successfully applied; such certificates to be delivered to the Society on or before the first Tuesday in February, 1821.

CULTIVATION OF HEMP IN UPPER CANADA.

192. To the person who shall sow with Hemp the greatest quantity of land in the province of Upper Canada, not less than six arpents (each four-fifths of a statute acre), in the year 1820, and shall at the proper season cause to be plucked the summer Hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed), on the ground until the seed is ripe;—*the Gold Medal*, or *One Hundred Dollars.*

193. To the person who shall sow with Hemp the next greatest quantity of land in the same province of Upper Canada, not less than five arpents, in the year 1820, in the manner abovementioned;—*the Silver Medal* or *Eighty Dollars.*

194. For the next greatest quantity of land, in the same province, and in a similar manner, not less than three arpents;—*Forty Dollars.*

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad-cast or in drills, the expense, soil, cultivation and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, together with 28 lbs. of the hemp, and two quarts of the seed, on or before the last Tuesday in April, 1822.

CULTIVATION OF HEMP IN LOWER CANADA.

195 to 197. Premiums exactly similar in all respects to those held out for the province of Upper Canada, are also offered for the province of Lower Canada.

CULTIVATION OF HEMP IN NOVA SCOTIA AND NEW BRUNSWICK.

198 to 200. Similar premiums in all respects are also offered to the provinces of Nova Scotia and New Brunswick.

IMPORTATION OF HEMP FROM CANADA, NOVA SCOTIA, AND NEW BRUNSWICK.

201. To the person who shall import to this country the greatest quantity of Marketable Hemp, not less than one hundred tons, in the year 1820, the produce of Canada, or of one of the abovementioned provinces;—*the Gold Medal.*

202. To the person who shall import the next quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel on or before the first Tuesday in February, 1821, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

SUBSTITUTE FOR HEMP.

203. To the person who, in the year 1820, shall discover and produce to the Society a substitute for Hemp, equally cheap, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal*, or *Fifty Guineas.*

A quantity of the substitute not less than one hundred weight, together with the proper certificates from the governor or commander in chief, if raised in any of the British colonies, or from the Secretary of the Board of Trade, if raised in the East Indies, to prove that the same has been used with success, to be produced to the Society on or before the last Tuesday in February, 1821.

N. B. The premiums from No. 191, to 203, are all extended one year farther, on similar conditions.

SILK.

204. For the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, produced by any person in the Isle of France, Ceylon, or Malta, or islands near or adjacent thereto, in the possession of Great Britain, in the year 1819, from Silk-worms bred there;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the Silk, not less than one pound, with an account of the method in which the Silk-worms were managed; the kind and size of the mulberry-trees from whence they were furnished with food, and particulars respecting

the culture of the mulberry trees for that purpose, to be produced to the Society on or before the first Tuesday in March, 1821.

205. For the next greatest quantity, not less than fifty pounds, on similar conditions—*the Silver Medal*, or *Twenty Guineas.*

Satisfactory certificates from the governor or commander in chief of the district where the said Silk was produced, and of the several particulars above mentioned, to be delivered to the Society along with the samples required.

N. B. The same premiums, on similar conditions, will be given for Silk produced in the year 1820.

WOOL FROM NEW SOUTH WALES.

206. To the person who, previous to February 1822, shall import into Great Britain or Ireland, the greatest quantity, not less than two tons, of fine wool, the produce of New South Wales;—*the Gold Medal.*

Proper certificates, with the bills of lading, and samples of the wool, to be produced to the Society on or before the last Tuesday in February 1822.

207. For the next greatest quantity, not less than one ton, on similar conditions;—*the Silver Medal.*

FINE WOOL FROM NEW SOUTH WALES.

208. To the person who shall produce to the Society the finest sample of wool, the produce of New South Wales, superior to the best Saxon or Spanish;—*the Gold Medal.*

Not less than 14 lbs. of the wool to be produced to the Society on or before the last Tuesday in February, 1822, together with certificates, that at least 5 cwt. equal to the sample has been imported by the claimant.

EXTIRPATING THE STUMPS AND ROOTS OF TREES.

209. To the person who shall invent and discover to the Society the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees which have been left after felling the timber, so as to clear the land for the purposes of cultivation;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the method has succeeded with at least fifty trees of large girth, and a full description of the means employed, to be delivered to the Society on or before the last Tuesday in February 1821.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH SETTLEMENTS IN THE EAST INDIES.

INDIA PAPER FOR COPPER PLATE PRINTING.

210. To the person who shall communicate to the Society the best account of the process employed in India or China in the manufacture of paper used in England for Copper Plate Printing, and known by the name of India Paper, together with an account of the materials from which such paper is made;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates signed by the Secretary of the Government or Board of trade of the respective settlement, to be produced to the Society on or before the first Tuesday in March, 1822, or 1823.

BHAUGULPORE COTTON.

211. To the person who shall import into the port of London, in the year 1819, the greatest quantity, not less than one ton of the Bhaugulpore Cotton, from which Cloths are made in imitation of nankin, without dying;—*the Gold Medal.*

A quantity of the Cotton, not less than five pounds weight in the pod, and five pounds carded, to be produced to the Society, with proper certificates, signed by the Secretary of the Board

of Trade of Bengal or Bombay, on or before the last Tuesday in February, 1821.

ANNATTO.

212. To the person who, in the year 1820, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of annatto, not less than five-hundred weight;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1821.

TRUE COCHINEAL.

213. To the person, who in the year 1820, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of true Cochineal, not less than three hundred weight;—*the Gold Medal.*

A quantity of the Cochineal, not less than three pounds weight, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the Cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1821.

N. B. The premiums from No. 210 to 213 inclusive, are all extended two years farther on similar conditions.

BRITISH MARBLES.

THE SOCIETY considering that it would be beneficial to the Commerce of the United Kingdom to bring the British Marbles into general use, and that the most effectual method of accomplishing their object would be, *for the present*, to make them more generally known in the Capital, have come to the following Resolution:

Resolved, That specimens of British Marbles be exposed in the Society's Rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name of the parish where situated, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the Marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of Marble Quarries will favour them with a specimen of the Marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected that the interest of the proprietors of the quarries will be promoted, and the use of British Marble much extended. A variety are already exhibited in the Society's Rooms.

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REWARDS

REWARDS BESTOWED BY THE SOCIETY DURING THEIR SESSION WHICH COMMENCED ON THE FIRST WEDNESDAY IN NOVEMBER, 1819, AND CLOSED ON THE SECOND WEDNESDAY IN JUNE, 1820.

To Mr. W. Wyon, of the Royal Mint, for the Dies of the new large Medal of the Society, designed and executed by him, and presented by him to the Society, *the first Gold Medal.*

IN AGRICULTURE AND RURAL ECONOMY.

1. *To the Duke of Devonshire,* for planting 550 acres with Forest Trees, *the large Gold Medal.*
2. *To J. Ridgway, Esq. of Ridgmont, near Bolton, Lancashire,* for reclaiming 81 acres of waste land, *the large Gold Medal.*

IN CHEMISTRY AND MINERALOGY.

1. *To S. Hibbert, M. D. Hill Place, Edinburgh,* for the Discovery of Chromate of Iron in Shetland, *the smaller, or Isis, Gold Medal.*
2. *To Mr. H. Stokes, Hatton Garden,* for a Hydrometer, *the smaller, or Isis, Silver Medal, and Ten Guineas.*
3. *To Mr. R. Jamieson, Glasgow,* for a Marine Thermometer Case, *the large Silver Medal.*
4. *To Mr. J. Rose, Coalport, Shropshire,* for his improved Glaze for Porcelain, *the smaller, or Isis, Gold Medal.*

IN POLITE ARTS.

Honorary Class.—1. ORIGINAL.

1. *To Mr. W. Johns, Plymouth,* for a Drawing of Butterflies from Nature, *the smaller, or Isis, Silver Medal.*
2. *To Miss E. Coppin, Norwich,* for an Oil Painting of Flowers, *the large Gold Medal.*
3. *To Miss Fr. Strickland, Righton, Yorkshire,* for a Drawing of Flowers in Water Colours, *the smaller, or Isis, Silver Medal.*
4. *To Miss A. Woodyear, Dulwich,* for a Drawing of Flowers in Water Colours, *the smaller or Isis, Silver Medal.*

2. COPIES.

5. *To Mr. R. Turner, Great Hermitage Street, Wapping,* for an Oil Painting of a Burgomaster and his Wife, *the large Silver Medal.*
6. *To Mr. W. J. Smith, Upper Conway Street, Fitzroy Square,* for a Pen and Ink Drawing of Figures of Two Dogs, *the large Silver Medal.*
7. *To Miss Copland, Fountain Hall, Aberdeen,* for a Landscape in Oil, *the smaller, or Isis, Silver Medal.*
8. *To Miss S. Gage, Kentish Town,* for a Landscape in Oil, *the Large Silver Medal.*
9. *To Miss Stephens, Dorset Square,* for a Portrait in Oil, *the smaller, or Isis, Silver Medal.*
10. *To Miss J. Murray, Paragon, Kent Road,* for a Chalk Drawing of Figures, *the Silver Palette.*
11. *To Miss A. Beaumont, Poland Street,* for an Oil Painting of the Golden Age, from West, *the large Silver Medal.*
12. *To Miss H. S. Smith, East Street, Red Lion Square,* for a Drawing in Indian Ink of Samuel and Eli, *the large Silver Medal.*

Class for Artists and others.—1. ORIGINAL.

13. *To Mr. P. Williams, Hart Street, Covent Garden,* for a Landscape in Water Colours, *the large Silver Medal.*
14. *To Mr. H. Wincles, Colebrook Row, Islington,* for a Pen and Ink Drawing of St. Mary's abbey, York, *the smaller, or Isis, Silver Medal.*
15. *To Mr. H. Ross, Charlotte Street, Fitzroy Square,* for a Portrait of a Lady in Water Colours, *the smaller, or Isis, Gold Medal.*
16. *To Mr. W. Edwards, Perceval Street,*

Northampton Square, for a Portrait in Oil, *the large Silver Medal.*

17. *To Miss Cotton, Chichely, near Newport Pagnel*, for a Water Colour Painting of Fruit and Flowers, *the large Silver Medal.*

18. *To Miss M. Ross, Upper Charlotte Street, Fitzroy Square*, for portraits of Two Children in Water Colours, *the Silver Palette.*

19. *To Miss G. Huntly, Buckingham Place, Fitzroy Square*, for a miniature of the Duke of Gordon, *the large Silver Medal.*

20. *To Miss A. Gaitskell, Paragon, Kent Road*, for a Drawing in Water Colours of Fruit and Flowers, *the large Silver Medal.*

2. Copies.

21. *To H. H. White, Esq. Lincoln's Inn*, for a Chalk Drawing of a Lioness, *the smaller, or Isis, Silver Medal.*

22. *To Mr. F. Say, Norton Street, Marybone*, for Two Heads in Coloured Crayons, *the large Silver Medal.*

23. *To Mr. W. Giller, Bath*, for a Copy, in Pencil, of a Landscape from Wilson, *the smaller, or Isis, Silver Medal.*

24. *To Mr. J. A. Cahusac, Lucas Street, Commercial Road*, for a Pen and Ink Drawing of the Death of Wat Tyler, *the Silver Palette.*

25. *To Mr. I. H. Farrer, Euston-street, Euston-square*, for a Landscape in Water Colours, *the smaller, or Isis, Silver Medal.*

26. *To Mr. H. Crellin, Ratcliffe Highway*, for a Chalk Drawing of West's Eve, *the Silver Palette.*

27. *To Mr. J. Davis, New Bond-street*, for a Head of Minerva, in Water Colours, *the smaller, or Isis, Silver Medal.*

28. *To Mr. J. Kennedy, New Bond-street*, for a Drawing, in Water Colours, of a Figure, *the Silver Palette.*

29. *To Mr. J. G. Jackson, Lower Brook-street*, for a Landscape in Water Colours, *the Silver Palette.*

30. *To Mr. H. C. Slous, Camden Town*, for a Portrait in Oil, from Rembrandt, *the large Silver Medal.*

31. *To Mr. W. Armer, jun. Rawlagh-street, Pimlico*, for a Portrait in Oil, from Rembrandt, *the smaller, or Isis, Silver Medal.*

32. *To Mr. W. Watts, Hampstead*, for a Portrait in Oil, from Rembrandt, *the large Silver Medal.*

33. *To Mr. C. W. Pegler, Newcastle-street, Strand*, for a Portrait in Oil, *the smaller, or Isis, Silver Medal.*

34. *To Miss Hart, Paternoster-row, Bishopsgate*, for a Chalk Drawing of Figures, *the Silver Palette.*

35. *To Miss L. C. Vassar, Rathbone-place*, for a Miniature, the head of Christ, *the large Silver Medal.*

36. *To Miss Turner, Warren-street, Fitzroy-square*, for a Chalk Drawing of a Goat, *the Silver Palette.*

37. *To Miss Winn, Bath*, for a Drawing of Flowers, in Water Colours, *the Silver Palette.*

Drawings from Figures and Busts.

38. *To Mr. J. C. Thurston, British Museum*, for a Chalk Drawing of the Elgin Theseus, *the Silver Palette.*

39. *To Mr. J. Wood, High-street, Whitechapel*, for a Chalk Drawing, from the statue of Libera, in the British Museum, *the large Silver Medal.*

40. *To Mr. G. Presbury, Upper John-street, Fitzroy-square*, for a Chalk Drawing from the statue of Hercules, in the British Museum, *the Silver Palette.*

41. *To Mr. W. Bagg, Frith-street, Soho*, for a Chalk Drawing from the Ilissus, in the Elgin collection, *the large Silver Medal.*

Original Architectural Designs.

42. *To Mr. R. Kelsey, Wilson-street, Finsbury-square*, for a Design for a National Museum, *the Silver Medallion.*

43. *To Mr. E. Taylor, Salisbury-street, Strand*, for a Design for a National Museum, *the smaller, or Isis, Silver Medal.*

44. *To Mr. E. Jones, Providence-street, Finsbury-square*, for a Design for a National Museum, *the smaller, or Isis, Silver Medal.*

Models.—1. Original.

45. *To Mr. W. Scoular, Edinburgh*, for a Group, Brutus and his Son, *the smaller, or Isis, Gold Medal.*

46. *To Mr. J. Dinham, Pimlico*, for his restoration of the Ilissus, of the Elgin collection, *the large Silver Medal.*

47. *To Mr. F. Mace, Pimlico,* for his restoration of the Ilissus, of the Elgin collection, *the smaller, or Isis, Silver Medal.*

2. COPIES.

48. *To Mr. J. Wyon, Birmingham,* for a Head in Miniature, *the smaller, or Isis, Silver Medal.*

49. *To Mr. W. Theed, Dean-street, Soho,* for a figure of Hercules, from the British Museum, *the Silver Palette.*

50. *To Mr. R. B. Hughes, Long-acre,* for a copy of the Barbarini Faun, *the large Silver Medal.*

MEDAL DIE ENGRAVINGS.

51. *To Mr. B. Faulkner, Birmingham,* for a Group, *the large Silver Medal.*

52. *To Mr. T. J. Wells, Birmingham,* for the Head of Christ, *the smaller, or Isis, Silver Medal.*

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53. *To Mr. S. Henning, Pentonville,* for five Intaglios, *the large Silver Medal.*

54. *To Mr. A. Harrison, Charlotte-street, Rathbone-place,* for a Parallel ruler, *the smaller, or Isis, Silver Medal.*

IN MECHANICS.

1. *To Mr. Austen, Waltham Abbey,* for his improvement in Corn Mills, *the large Silver Medal.*

2. *To Mr. R. Pering, Clerk of the Checque, Plymouth Dock,* for an improved Mud Boat, *the large Silver Medal.*

3. *To Mr. F. C. Cherry, Percy-mews, Rathbone-place,* for improved Springs and Blocks for Carts, *the large Silver Medal.*

4. *To Mr. J. Smith, Newcastle-street, Fleet-market,* for an improved Umbrella, *the smaller, or Vulcan, Silver Medal, and Five Guineas.*

5. *To Mr. J. White, Laystall-street, Liquorpond-street,* for a double Door Spring *Five Guineas.*

6. *To Mr. J. Perkins, Austin Friars,* for an improved Ship's Pump, *the large Gold Medal.*

7. *To the same,* for a method of freeing Water Wheels from back water, *the smaller, or Vulcan, Gold Medal.*

8. *To the same,* for improvements in Engine Hose, *the large Silver Medal.*

9. *To Captain G. F. Stack, Thayer-street, Manchester-square,* for an Apparatus for the use of those who have lost an arm, *the smaller, or Vulcan Gold Medal.*

10. *To Mr. W. Hookey, Assistant Builder, Woolwich Dock-yard,* for various improvements in Naval Architecture, *the large Gold Medal.*

11. *To Captain James Burton, R. N. Portsmouth,* for a method of propelling Ships of War, *the smaller, or Vulcan, Gold Medal.*

12. *To Mr. J. Gorman, Oxford-street,* for a Spring Bandage, *the large Silver Medal.*

13. *To Mr. J. Prior, Nessfield, near Skipton,* for the Striking part of a Clock, *the large Silver Medal, and Twenty Guineas.*

14. *To Messrs. Jeffries and Halley, Great Guilford-street, Southwark,* for a Blowing Machine, *the large Silver Medal, and Fifty Guineas.*

15. *To Mr. A. Ainger, Everett-street,* for a Spring Latch, *the smaller, or Vulcan, Silver Medal.*

16. *To Mr. O. Elliot, Westminster Bridge Road,* for a Safe Coach, *the large Gold Medal.*

17. *To Mr. G. Davies, Cannon-street,* for a Sun Dial, *the large Silver Medal.*

18. *To Mr. Joseph Jopling, Somerset-street, Portman-square,* for his improved construction of the Ribs of groined Arches, *the smaller, or Vulcan, Gold Medal.*

19. *To Mr. R. King, Thames-street, Bankside,* for his improved method of making Anvils, *the smaller, or Vulcan, Silver Medal,* and *Five Guineas.*

20. *To Mr. W. Bullock, Star-court, Compton-street, Soho,* for a Ball Valve for Cisterns, *Five Guineas.*

21. *To Mr. J. Skinner, Dean-street, Holborn,* for a Machine for sweeping Chimnies, *the lesser, or Vulcan, Silver Medal, and Ten Guineas.*

22. *To Mr. H. C. Jennings, Carburton-street, Fitzroy-square,* for a Mercurial Log Glass, *the large Silver Medal.*

23. *To A. H. Holdsworth, Esq. M. P. Dartmouth,* for an improved method of constructing Roofs, *the large Silver Medal.*

24. *Mr. W. Hardy, Wood-street, Coppice-row, Cold Bath-fields,* for a detached Clock Escapement, *the large Gold Medal, and Fifty Guineas.*

25. *To Mr. H. Trengrouse, Truro,* for an Apparatus for saving lives in case of Shipwreck, *the large Silver Medal, and Thirty Guineas.*

IN COLONIES AND TRADE.

To Mr. J. F. Donovan, Leith, for Curing British Herrings, *Fifty Pounds.*

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PAPERS

IN

AGRICULTURE.

N° I.

PLANTING FOREST TREES.

The GOLD MEDAL *of the Society, being the premium offered, was this Session awarded to his Grace the* DUKE *of* DEVONSHIRE, *for planting* 1,981,065 FOREST TREES. *The following communications on the subject have been received from Mr.* JOHN MACHELL, *Agent to his Grace.*

Low Plains, near Penrith,
February 1st, 1820.

SIR;

On a division of the extensive wastes of Inglewood Forest, in the county of Cumberland, a few years ago, three allotments containing together upwards of 1,800 acres, were awarded to his Grace the Duke of Devonshire, who was Lord of the Forest, and had also a considerable claim upon it in right of his ancient estate within its limits. Two of these allotments, the situation and soil of which

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offered a reasonable inducement for investing capital in their improvement, have been inclosed, sub-divided, and proper farm buildings erected upon them, and they have since been brought into a high state of cultivation. The third allotment called the High Stand, which was considerably more sterile, and afforded no such inducement, was annexed to one of the others, as an out pasture, for two years after inclosure; but finding that in this state it yielded only a low rate of interest upon the money expended in erecting its boundary walls, it became necessary to consider in what way it could be better employed, with a view to either immediate or prospective advantage. The profitable result of an attempt to bring it into cultivation was more than doubtful; and the well known benefits which have resulted from planting lands of this description, as shown by daily experience, and very ably pointed out in the ingenious and valuable communications made to the Society in the years 1808 and 1809, by one of its members (Mr. Waistell) have led to its appropriation to that purpose. His Grace was pleased to direct that the whole of this extensive tract of ground (with such reservation only as is more particularly described hereafter) should be planted with useful Forest Trees, in such proportions as were suitable to the nature of the ground; and that this object should be carried into effect during the winter of 1816, a season of unprecedented scarcity of employment for the labouring poor.

Accordingly, as a preliminary step to the planting, all the super-abundant water was taken off the boggy and moist lands by open drains, varying as was requisite from 2 to 3½ feet in depth; and of these drains 7,958 statute rods were cut, at different prices, from 2*d.* to 6*d.* per rod, making a total expense of 109*l.* It was also found necessary to root up and burn the furze or whins with which the surface of the ground was in some parts covered, in order

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to make room for the plants, and to obviate the danger of their being smothered in their early growth.

The soil consists of three distinct varieties. The first is a dry, sandy, deaf soil, varying from 6 to 8 inches in depth, with red freestones occasionally embedded in it, and upon a substratum of sand. The second is a wet soil of 7 or 8 inches deep, principally composed of fine sand, with a small admixture of clay, and upon a wet subsoil of sand and ferruginous clay. The 3rd and worst kind, is of a wet, peaty nature, black in colour, 4 or 5 inches in depth, with white stones upon its surface, and resting upon a coarse grey sand, under which is found a retentive stratum of sand and clay.

On the 29th of November 1816, the planting commenced, and the whole plot containing 550 acres, 1 rood, 6 poles, exclusive of fences and of the roads out set for carrying away the thinnings, was completed on the first day of April 1817.

The plants were set at the distance of 4 feet asunder, or 2,722 per acre, one-fourth part of which number, and these consequently standing 8 feet apart, consisted of hard wood, under which denomination are comprehended oak, ash, elm, beech, sycamore, alder, birch and poplar, the term being used by the planters of this part in contradistinction to the pinus class. The hard wood planted on the better soils had been generally 3 years transplanted, on the inferior 2 years; and being more uncertain in its growth, and having also larger roots than the larch, Scotch and spruce firs, which were only of 1 and 2 years transplanting, it was thought desirable to give them the advantage of pitting, or of having a sod cut to a proper depth and turned out some time previous to planting; the plant being afterwards placed in the centre of the pit, and the sod cut in two, the halves were returned to their proper situation on each side of the plant, and closely

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pressed about it. The object of pitting was to obtain a better adjustment of the roots, and to afford the soil the benefit of exposure to atmospheric influence, so as to enable this description of wood to keep pace with its more hardy and quick growing competitors of the fir kind. With these latter, the shorter and more simple method was pursued, of making two cuts with the spade, in the form of the letter T, then raising the sod at the junction of the cuts, and pressing it down again after the plant was introduced. The larch and Scotch firs were distributed over the whole plantation, but proper circumspection was used in planting the different kinds of hard wood upon those soils best adapted to their respective growths; and accordingly on the wet and thin peat soil, where the more valuable hard wood will not grow, alder, birch, poplar, and Huntingdon and tree willows were substituted; whilst a larger proportion of oak, ash, elm, beech and sycamore, occupies the dry land, and the better kind of wet land, which, as before observed, had been previously fitted for its reception by draining.

The cost of the trees, with the expence of carriage, and planting, amounted to 2*l.* 16*s.* per acre, with an addition of 8*s.* per acre for upholding the plants for 3 years, and replacing every season such as died. The respective quantities of each of the different kinds will be seen in the following statement, which is verified by the inclosed certificates of the planters.

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KINDS.	Number planted between Nov. 1816, and April 1817.	Ditto planted in 1817-18 to replace such as had failed.	Ditto 1818-19.
Larches . . .	647,156	186,512	146,460
Scotch Firs . .	504,208	39,252	31,890
Spruce . . .	43,860	3,324	3,125
Silver Firs . .	122	—	—
Oaks	125,988	11,200	9,304
Ashes	77,601	3,700	5,213
Elms	50,883	2,300	960
Beech	17,562	700	300
Sycamore . . .	30,768	500	102
Alder	19,143	367	102
Birch	7,172	185	102
Poplar	5,180	123	—
Willows . . .	3,508	122	102
Hornbeam . .	1,224	—	
Chesnuts and Ornamental trees	745	—	—
		—	—
	1,535,120	248,285	197,660

It will be seen by the above statement, that the trees originally planted amount to 1,535,120, and that 445,945 have been since added to supply the place of those that had failed. The hardiness of the Scotch fir, and the great advantage to be expected from the shelter it affords to such trees as are less capable of bearing an exposed situation, have led to the introduction of a much greater number of that kind than the value or usefulness of its wood might seem to recommend, but as a large proportion of the aggregate number of trees planted, must in due time be thinned out, this description, when its useful object is answered, will principally be removed to afford room for those more valuable trees which it has contributed to nurse. The larches have required considerably the most replacing, but this circumstance was occasioned by the ravages of a small insect, resembling the wire worm, from

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$\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length, which preyed upon the roots, and thereby destroyed the plants. Fortunately the injury was confined exclusively to the larches, and to such of these only as were planted on the dry soils, where they were expected to thrive the best. From 10 to 20 worms, and sometimes more, have been observed at the roots of one plant.

At the present time the whole plantation presents a healthy and thriving appearance; and to meet any future deficiencies that may possibly occur, a plot of ground containing about one acre near the plantation, has been trenched, and planted with seedlings of different descriptions.

The great extent of this plantation, the length of its boundary fences, and the risk that such parts of them as were made by adjoining proprietors (which constitute upwards of $\frac{1}{3}$ of the whole) might, if insufficiently attended to, allow the trespassing of cattle, made it desirable to place some person on the spot, whose vigilance might preserve the plantation from trespass, and who would promptly repair any gaps that might be made in the walls, as well as replace such plants as should chance to die after the expiration of the three years, during which they were to be maintained by the original planters. But as these objects alone were insufficient for the constant employment of the person who was selected for this important trust, a plot of 42 acres of the best land the allotment contained, situated about the middle of the tract, was fenced round, and converted into a farm, with the addition of a cottage and suitable out-buildings, for its occupation. The fence which separates this farm from the plantation, and those boundary fences also which are made by the owners of adjoining allotments, are principally quicksets, protected by railing placed on the top of a cam or earthen mound about 3 feet in height; the rest

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of the fences which inclose this plantation are good and substantial stone walls 6 quarters high.

It may not be improper to mention, that in addition to this plantation several smaller ones, containing together 5 acres, 1 rood, 34 poles, were also made, upon similar principles, on the other two allotments, between the months of November 1816, and April 1817. The total quantity therefore of land planted by his Grace at that time, amounts to 555 acres, 3 roods; and the trees to 1,550,470.

In thus bringing before the Society, as a candidate for the honour of its reward, the noble individual whose views in this extensive undertaking it has been my duty to carry into effect, I indulge the hope, that the magnitude of the object attained, and the measures adopted for its accomplishment, as detailed in the foregoing communication, may be considered not undeserving the favourable notice of the Society.

I am, Sir,

&c. &c. &c.

JOHN MACHELL,

Agent to his Grace, the Duke of Devonshire.

A. Aikin, Esq, Secretary, &c. &c.

CERTIFICATES.

WE the undersigned do hereby certify, that we are well acquainted with the High Stand plantation belonging to his Grace the Duke of Devonshire, and that we consider the foregoing to be a faithful and correct statement.

As witness our hands the 2nd day of February 1820.

JOHN HARRISON, *Minister of Hesket, in the Forest.*

JAMES WATSON, *Land Surveyor, Low Plains.*

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Number of Forest Trees planted upon High Stand, in 1817.

Larch firs	57,300	
Scotch firs	38,600	
Ash	7,100	
Elms	7,400	
Oaks	7,400	
Beech	4,400	
Alders	3,900	
Spruce	4,500	
Mountain ash	1,400	
Poplars, of sorts	600	
Ornamental trees, of sorts	500	
Total . .	133,100	
To filling up in 1818 . .	13,200	of various sorts.
Do. in 1819 . .	22,000	Do.
In all . .	168,300	

W. & T. Hutton, *Planters.*

A description of Trees planted on the High Stand, the property of his Grace the Duke of Devonshire.

Dec. 1816, 1817.	Larches .	68,000	
	Firs . .	40,000	
	Oaks . .	12,000	
	Ashes . .	4,000	
	Sycamores	4,000	
	Beeches .	3,000	
	Elms . .	5,000	
	Alders .	4,000	
	Birches .	2,000	
	Spruce .	1,000	
	Poplars .	1,000	
			Planted 1st year 144,000

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			Brought forward 144,000
1818.	Larches .	20,000	
	Firs . .	4,000	
	Oaks . .	1,000	
	Ashes. .	500	
	Sycamores	500	
	Beeches .	500	
	Elms . .	2,000	
			To fill up 2nd year 28,500
1819.	Larches .	10,000	
	Firs . .	2,000	
	Oaks . .	500	
	Ashes .	200	
			To fill up 3rd year 12,700
			Total planted 185,200

I do hereby certify that this is a correct statement of the Trees planted by me on the High Stand.

ADAM SMILLIE, *Planter.*

A description of Trees planted on the High Stand, the property of his Grace the Duke of Devonshire.

Dec. 1816, 1817.	Larches . .	391,500
	Scotch firs	195,700
	Spruce firs	20,000
	Oaks . .	87,850
	Ashes . .	43,925
	Elms . .	20,000
	Sycamores	10,000
	Beeches .	6,000
	Alders . .	5,000
	Birches .	1,500
	Poplars .	1,500
		782,975 planted the first year.

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1818.	Larches	110,000
	Scotch firs	12,000
	Oaks	10,000
	Ashes	3,000
	Spruce firs	2,000
		137,000 to fill up the second year.
1819.	Larches	95,000
	Scotch firs	8,000
	Spruce firs	1,500
	Oaks	8,000
	Ashes	4,000
		116,500 to fill up the third year.

I do hereby certify that this is a correct statement of the Trees planted by me on the High Stand.

JOHN MOSES, *Planter.*

Hassendeanburn, near Hawick,
28th January, 1820.

Trees planted on High Stand plantation, belonging to his Grace the Duke of Devonshire, by Arch. Dickson and Sons, Nurserymen, Hassendeanburn.

1816.	3,000	Alders, 20 to 30 inches.
Nov. 29th.	3,000	Elms, 20 to 30 inches.
	3,000	*Planes, 20 to 30 inches.
	3,000	Oaks, 1½ to 2 feet.
	600	Beeches, 10 to 18 inches.
	360	Mountain ashes, 20 to 30 inches
Dec. 3rd.	600	Norway spruce, 10 to 16 inches.
	3,000	Ashes, 20 to 30 inches.
	3,000	Elms, 20 to 30 inches.
	3,000	Planes, 20 to 30 inches.
	22,560	(Carried forward.)

* The wood *Plane* is used in this list in the Scotch sense, signifying Sycamore. *Sec.*

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Dec. 3rd.	22,560	(Brought forward.)
	3,000	Oaks, 1½ to 2 feet.
	600	Beeches, 10 to 15 inches.
1817.	360	Mountain ashes, 20 to 30 inches.
Feb. 11th.	3,000	Ashes, 20 to 30 inches.
	3,000	Elms, 20 to 30 inches.
	3,000	Planes, 20 to 30 inches.
	1,810	Oaks, 1 to 1½ foot.
	1,200	Spruce, 10 to 16 inches.
	360	Mountain ashes, 20 to 30 inches.
Mar. 5th.	31,200	Scotch firs, 1 year transplanted.
	12,000	Larch, 10 to 16 inches.
	2,400	Ash, 16 to 24 inches.
	1,200	Planes, 12 to 15 inches.
	1,200	Elms, 15 to 18 inches.
	1,200	Norway spruces, 9 to 12 inches.
7th.	2,760	Oaks, 10 to 16 inches.
	3,000	Ash, 15 to 20 inches.
	3,360	Elms, 15 to 20 inches.
	2,640	Planes, 15 to 20 inches.
	360	Mountain ashes, 15 to 18 inches.
	1,200	Norway spruces, 9 to 12 inches.
	24,000	Scotch firs, 1 year transplanted.
	6,000	Ditto, 2 years ditto.
	12,000	Larches, 9 to 14 inches.
	2,400	Ditto, 10 to 18 inches.
	600	Beeches, 10 to 14 inches.
11th.	3,600	Oaks, 10 to 16 inches.
	2,760	Ashes, 10 to 18 inches.
	2,160	Elms, 15 to 18 inches.
	1,800	Planes, 15 to 18 inches.
	480	Mountain ashes, 18 to 24 inches
	600	Beeches, 10 to 14 inches.
	157,810	(Carried forward.)

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	157,810	(Brought forward.)
Mar. 11th.	2,400	Spruce, 10 to 14 inches.
	16,800	Larches, 1 to 1½ foot.
	28,800	Scotch firs, 1 year transplanted.
	6,000	Ditto, 2 years ditto.
	480	Hornbeams, 1½ to 2 feet.
	240	Horse chesnuts, 2 to 2½ feet.
14th.	3,000	Oaks, 18 to 21 inches.
	3,000	Ashes, 1½ to 2 feet.
	1,800	Elms, 2 feet.
	1,200	Planes, 2 feet.
	1,200	Beeches, 8 to 12 inches.
	240	Mountain ashes, 1½ foot.
	360	Hornbeams, 1½ to 2 feet.
	1,800	Norway spruce, 8 to 15 inches.
	30,000	Scotch firs, 1 year transplanted.
	14,400	Ditto, 2 years transplanted.
	14,400	Larches, 10 to 18 inches.
	9,600	Ditto, 8 to 14 inches.
18th.	1,200	Norway spruce, 1 to 1½ foot.
	1,200	Ash, 1½ to 2 feet.
	600	Elms, 16 to 21 inches.
	600	Planes, 18 to 21 inches.
	1,200	Oaks, 9 to 15 inches.
	480	Beech, 1 to 1½ foot.
	240	Mountain ash, 15 to 18 inches.
	360	Hornbeams, 20 to 30 inches.
	20,400	Larches, 10 to 18 inches.
	15,600	Ditto, 9 to 15 inches.
	12,000	Scotch firs, 2 years transplanted.
	2,400	Ditto, 1 year ditto.
21st.	1,320	Huntingdon willows, 1½ to 2 feet.
	600	Dutch ditto, 1½ to 2 feet.
	351,730	(Carried forward.)

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	351,730	(Brought forward.)
Mar. 21st.	1,200	Black Italian poplars, 1 to 1½ foot.
	2,400	Birch, 1½ to 2 feet.
	960	Alders, 15 to 18 inches.
	960	Ditto, 24 to 30 inches.
	120	White poplars, 18 to 24.
	2,400	Norway spruces, 7 to 12 inches.
	12,000	Larches, 6 to 12 inches.
	2,400	Ditto, 10 to 18 inches.
	19,200	Scotch firs, 1 year transplanted.
	14,400	Ditto, 2 years ditto.
26th.	6,000	Norway spruces, 6 to 9 inches.
	18,000	Scotch firs, 1 year transplanted.
	9,400	Ditto, 2 years transplanted.
	1,520	Huntingdon willows, 20 to 30 inches.
	1,200	Birches 1½ to 2 feet.
	1,200	Alders, 1½ to 2 feet.
	720	Black Italian poplars, 12 to 21 inches.
	6,600	Larches, 10 to 18 inches.
	120	Silver firs, 10 to 12 inches.
April 1st.	3,600	Larch, 1½ foot.
	3,600	Scotch firs, 1 year transplanted.
1818.	6,000	Ditto, 2 years ditto.
March 3rd.	18,000	Ditto, 2 years ditto.
	13,200	Larches, 10 to 18 inches.
	4,800	Ditto, 7 to 10 inches.
	1,200	Norway spruce, 7 to 12 inches.
	2,400	Scotch firs, 1 year transplanted.
	360	Alders, 12 to 15 inches.
	180	Birches, 1½ foot.
13th.	10,800	Larch, 9 to 15 inches.
27th.	6,000	Ditto, 1 to 1½ foot.
April 7th.	10,800	Ditto, 1 to 1½ foot.
	533,470	(Carried forward.)

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	533,470	(Brought forward.)
April 7th.	240	Scotch firs, 2 years transplanted.
	120	Black Italian poplars, 2 feet.
	120	Huntingdon willows, 2 to 3 feet.
Nov. 12th.	100	Alders, 1 foot.
	100	Tree willows, 2 to 3 feet.
	100	Ashes, 2 feet.
	100	Elms, 2 feet.
	150	Oaks, 15 to 18 inches.
	100	Mountain ash, 2 feet.
	100	Birches, 15 to 18 inches.
	100	Planes, 2 feet.
	4,000	Scotch firs, 1 year transplanted.
	1,500	Ditto, 2 years ditto.
	7,000	Larch, 7 to 12 inches,
1819.	1,000	Spruce, 6 to 12 inches.
Feb. 1st.	8,000	Larch 8 to 16 inches.
	2,000	Scotch firs, 2 years transplanted.
	1,000	Ditto, 1 year ditto.
Dec. 3rd.	5,000	Ditto, 2 years ditto.
	5,000	Larches, 10 to 16 inches.
	300	Ashes 1½ foot.
	400	Elms, 1½ foot.
	300	Oaks, 12 to 15 inches.
	200	Spruces, 1 foot.
21st.	6,000	Scotch firs, 2 years transplanted.
	3,000	Larches, 8 to 16 inches.
	579,500	
	11,590	Incast of 2 to each hundred.
Total . .	591,090	

ARCHIBALD DICKSON & SONS.

High-Stand Cottage,
January 31st, 1820.

I DO hereby certify that his Grace the Duke of Devon-

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shire's High Stand Plantation is well and effectually fenced round; that the young trees appear to be in a healthy and flourishing condition; and that I have taken every possible pains to preserve the trees by preventing trespasses in the plantation.

CUTHBERT RAINE, *Woodman.*

N° II.

RECLAIMING WASTE LAND.

The GOLD MEDAL *of the Society, the Premium offered, was this Session awarded to* JOSEPH RIDGWAY, *Esq., of Ridgmont, near Bolton, Lancashire, for reclaiming* 81 *Acres of* WASTE LAND. *The following communication has been received from him on the subject.*

Ridgmont,
January 1st, 1820.

SIR;

I SHALL feel much obliged if you will have the goodness to lay before the Society for the encouragement of Arts, Manufactures, and Commerce, the following improvements I have made in cultivating Waste Land, which I trust will in some degree be applicable to the premiums in agriculture offered by them in 1819: premium 43, for improving Waste Land; hoping that on examining the following statements I may have some small claim to the premium offered. Towards the latter end of 1816 I began my improvements upon a part of Horwich Moor, situate in the parish of Dean and county of Lancaster, four miles north of Bolton-le-Moors, which

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was inclosed under the powers of an act of parliament in 1815, and the quantity of land which I beg leave to submit to the notice of the Society as improved is 81 acres, 49 of which were covered with strong heath on black peat from 15 inches to 2 feet deep, part dry, part wet; 7 acres were rough uneven land, containing a great number of old stone pits, where stone had been got for ages for the repairs of the public and private roads, and for buildings; and about 25 acres were clay land, with about 6 inches of brown soil upon it, also part wet and part dry: this last produced a short bent grass of little value. The whole has undergone the following improvements:

	£.	s.	d.
The 49 acres of land, the heath was mown off, burned, and the ashes spread upon the land; part of it was very stony and uneven; and the clearing from stone, levelling, mowing, and burning the heath cost . . or, about 6*l.* per acre.	289	19	0
The rough stone pit land of 7 acres, levelled and cleaned cost . . . . . or, about 19*l* per acre.	132	0	0
The 25 acres, part dug with spade and levelled, cost little more than 2*l.* 2*s.* per acre, or	53	0	0
The quantity of draining in the whole was 906 perches, which was done by the piece, averaging 2 feet 4 inches deep, laid with stone sough, the main drains 12 inches square, the side drains, some 8 others 6 inches square, averaging the expense of about 2*s.* 4*d.* per lineal rod, the whole costing	100	3	0
Carried forward	£.575	2	0

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	£.	s.	d.
Brought forward . . .	575	2	0

Upon the whole of this land, being very thin of soil and stoney, a great expense was incurred in collecting soil from the road-sides, and other places, where I could get any to cover it; after the land was cleaned of heath, levelled, and the wet parts drained, it underwent the following state of cultivation:

Eleven acres were dug into butts, or lands for potatoes, with the spade, cost 7*l.* 3*s.* 4*d.* per acre, or	78	16	8

Eight acres were dug and levelled with the spade, and sown with oats; another portion of 40 acres, 1 rood, 32 poles, was part dug with the spade and part ploughed, and laid down for pasture and meadow; another portion of 20 acres, 23 poles, after being cleaned, levelled, and dressed, was bone-dusted for pasture, and the dung, lime, and compost, laid upon the whole 81 acres, is as follows:

22,200 measures of lime, a measure being about one hundred weight, @ 11½*d.* per measure, is	1,063	14	4
880 tons compost and black dung, @ 11*s.* 6*d.* per ton	506	0	0
80 tons of small dung and soil, @ 5*s.* per ton	20	0	0
1,012 tons of black dung	480	0	0
2,040 measures of bone dust, @ 3*s.* 1½*d.* (This is not yet all spread, but ready when the weather will permit)	318	15	0
Carried forward . . .	£3,042	8	0

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	£.	s.	d.
Brought forward	3,042	8	0
Sundry cart-work in collecting soil, scrapings of the road, labourers wages, not taken into the above account	426	0	0
Potatoe sets, and setting 11 acres, @ 10*l*. .	111	0	0
Oats, ploughing and sowing 25 acres . . .	51	0	0
One acre of wheat	3	15	0
The land is divided into 25 inclosures by good stone walls, 6 feet, 10 inches high, 801 perches, which cost 13*s*. 3*d*. per lineal rod	530	13	6
847 rods of do. 4 feet, 10 inches high, @ 8*s*. 2*d*.	345	18	2
Roads made for the use of the land, 52 rods @ 14*s*.	36	8	0
105 rods of do. @ 6*s*.	31	10	0
	£.4,578	12	8

From these improvements there have been the following crops taken:

A.	R.	P.		£.	s.	d.
11	0	0	of potatoes produced 2,640 ms. @2*s*.	264	0	0
25	0	0	of oats, very good, @ 8*l*. . . .	200	0	0
32	0	0	mown of hay, very heavy crop, @ 5*l*.	160	0	0
1	0	0	of wheat	8	0	0
12	2	30	in pasture, crop worth	30	0	0
81	2	30		£.662	0	0

This land is situated in a very populous manufacturing country, and the object I had in view was to get the land improved as soon as possible; of course it has employed a very great number of hands. The land is laid down with

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white clover, trefoil, rib grass, and the best meadow hay-seeds, intending to have the whole in grass and to remain so, and divided into small farms, for which purpose I have built four farm houses, with suitable barns and out-buildings, which cost me 960*l.* not taken into the account. The land was of little or no value, except a few acres. Upon an average I now consider it worth 2*l.* per acre per annum, at least.

Thus, Sir, I have endeavoured, in as brief and plain a manner as I could, to put you in possession of the original state of the land, and of the means I have used to improve a very poor piece of waste uncultivated land, amounting to 81 acres, 2 roods, 30 poles, which has cost me 4,578*l.* 12*s.* 8*d.*, or on an average 56*l.* per acre; perhaps I might have done it at some less expense in the quantity of manure for the present, but I wished it to be done so as to continue a good herbage, as I do not intend it to be again broke up, but to lie as permanent pasture and meadow land. If any further information is required, I shall be happy to give it; and should my exertions obtain the favourable consideration and attention of the Society of Arts, &c. &c., it will afford me the highest gratification.

I am, Sir,
&c. &c. &c.
JOSEPH RIDGWAY.

A. Aikin, Esq.
Secretary, &c. &c.

N. B.—A plan is herewith sent of the improved land.

CERTIFICATE.

WE whose names are hereunto subscribed, do certify that we knew the land before the improvements were made, and have seen it frequently during the time they

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were going on, and we never saw waste-land better and more speedily and effectually made good. The stone walls for fences to the road sides are topped with triangular stones, set on an edge with lime mortar; the farm houses and out-buildings substantial, neat, and convenient, and the roads good: the crops were exceeding good and heavy, particularly the oats and hay grass. It was a part of Horwich Moor, situate in the parish of Dean, near Bolton, in the county palatine of Lancaster, and the property of Joseph Ridgway, Esq. of Ridgmont, in the said county; and we believe the annexed account is a true statement of the process and expense of improving the land, as well as of the produce reaped, and have the satisfaction to say we are confident it will be of great advantage to the neighbourhood.

THOMAS BROCKLEBANK, *Vicar of Dean.*
JOHN SHARPLES, *Churchwarden of Dean.*
RICHARD FLETCHER } *Commissioners for in-*
JOHN ASHWORTH } *closing the said Moor.*
THOMAS PLUMPTON, *Agent to Joseph Ridgway, Esq.*

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N° III.

CULTURE AND PREPARATION OF OPIUM IN BRITAIN.

Extract of a Letter from JOHN YOUNG, *Esq., Surgeon, Edinburgh, on the* CULTURE AND PREPARATION OF OPIUM IN BRITAIN, *supplementary to his communication on the same subject inserted in the 36th volume of the Transactions of the Society.*

Edinburgh,
March 15th, 1820.

SIR;

SINCE I had the honour to correspond with you on the subject of my communication to your Society respecting my mode of collecting British Opium, and for which I had the honour to receive the Gold Isis Medal, I was last summer engaged in the same experiment, on a larger scale than formerly, and I produced nineteen pounds and a half of opium, twenty-five gallons of poppy oil, and at the rate of 40 bolls of early potatoes, from 129 falls, 18 square yards, being 30 falls less than one acre of ground, by the mode of cultivating communicated to your Society, and afterwards more particularly detailed in the 2nd and 3rd Nos. of the Edinburgh Philosophical Journal, with this difference, that the gatherers collected the milky juice with their thumbs instead of brushes, which

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I consider to be a material improvement in the mode of gathering; and although I had from 12 to 20 boys, from 12 to 14 years of age, employed during the season, only two were affected with drowsiness, and I could not be certain whether this was the effect of the absorption of the opium, or of the extreme heat of the weather. By this new mode of gathering the milky fluid of the poppy one of the boys, more than once during the season of gathering, filled his flask in one day, of ten hours work; the flask contained 14 oz. which, when evaporated, gave *three ounces and two drachms of solid opium.* I may observe that owing to the extreme heat and want of rain during the last opium harvest, my plants came so rapidly to maturity, that I did not get so much opium as I probably should have done, had there been occasional showers.

I am, Sir,
&c. &c. &c.
JOHN YOUNG, *Surgeon.*

A. Aikin, Esq.,
Secretary, &c. &c.

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PAPERS

IN

CHEMISTRY.

N° I.

DISCOVERY OF CHROMATE OF IRON IN SHETLAND.

The smaller, or ISIS GOLD MEDAL *of the Society was this Session voted to* SAMUEL HIBBERT, M. D., *of Edinburgh, for the discovery of* CHROMATE OF IRON IN SHETLAND. *The following communication has been received from him on the subject.*

5, Hill Place, Edinburgh,
February 7, 1820.

SIR;

I HAVE the honour to make a communication to the Society of Arts, &c. &c., respecting the discovery which I originally made two years and a half ago, of the Chromate of Iron in the Shetland Islands, which substance is at present obtained for the manufacturers of colours at a considerable expense from the United States of America. Since a notice first appeared in the journals relating to the discovery, considerable inquiries have been made concerning it; but, that I might not create expectations

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which could not be realised, I was unwilling to make further communications on the subject until I had made a second visit to Shetland, when I ascertained that it exists there in great abundance. Conceiving, therefore, that the patriotic Institution of London for the promotion of the Arts and Commerce of Great Britain, was the most suitable medium through which the knowledge of the place and circumstances under which the chromate of iron is found might be first communicated to those who are commercially interested in the discovery, I have taken the liberty of transmitting to you a set of specimens,* which, in reference to the annexed description, will illustrate the varied character of the mineral. If my discovery shall be considered as a contribution to the commercial resources of the British Islands, it will afford me some recompense for the considerable time and labour which I have expended in the prosecution of the search after this important ore.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.
Secretary, &c. &c. SAMUEL HIBBERT, M.D.

Circumstances under which the Chromate of Iron is found in Shetland.

The Chromate of Iron occurs in the Serpentine rocks in the neighbourhood of Balta Sound, in the Island of Unst. I was first led to a search after this ore by observing innumerable fragments of it strewed about the hill in which it is found, and even contributing to strengthen the fences of the country. It is observed in the form of imbedded and insulated masses, at Buness, close to the house of the proprietor, Thomas Edmon-

* Which are now in the repository of the Society.

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stone, esq. The extent of the greatest mass is not, however, ascertained, as it is on one side concealed by the sea, and on the other by the deep soil of a meadow. It was traced 3 feet in breadth and fifteen feet in length. At Hagdale, near Haroldwick, the chromate of iron occurs in the form of numerous thin ramifying veins, but these are only from 2 to 3 inches in breadth, sometimes increasing to the breadth of 5 or 6 inches. Many masses are elsewhere observable, extending a few feet and then losing themselves in a general dissemination throughout the serpentine rock in which they occur. This dissemination consists in the diffusion of granular particles of the colour and size of gunpowder.

It is evident from this description that the most promising appearance of the ore is adjoining the house of Mr. Edmonstone, and from this gentleman, whom I have made acquainted with all the circumstances of the mineral, any commercial inquiry will meet with the most satisfactory answer. Letters may be directed, "Thomas Edmonstone, Esq., of Buness, Island of Unst, Shetland."

Upon the encouragement, however, from London will depend the renewed searches after the chromate of iron, not only on Mr. Edmonstone's grounds, but in the adjoining hills, which are the joint property of several landed proprietors in Unst. From the quantity, therefore, of the ore which has been found in detached portions on the hills, and from the promising appearance on Mr. Edmonstone's grounds, I would submit to the manufacturing chemists in London the propriety of rendering to the Shetland gentlemen every scientific assistance which they may require from their advice, or even if wanted, from other exertions in prosecuting the search after this ore, provided its quality suits their purpose. It appears to me that some serious obstacles cannot fail to

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result from the inexperience of the Shetland gentlemen in whatever concerns the operations of mining.

Vessels trading from Leith to Shetland visit Balta Sound almost every month in the course of the Spring and Summer.

In furnishing the foregoing particulars relating to the chromate of iron, I have only to add that I shall be happy to answer any personal inquiries on the subject, concerning whatever I may have left unexplained.

SAMUEL HIBBERT, M. D.

Portions of the specimens of chromate of iron transmitted by Dr. Hibbert were put into the hands of several members of the Society for examination, with respect both to the quality and richness of the ore as compared with that imported from the United States. Samples of chromate of lead prepared from the American and Shetland varieties of chromate of iron were laid before the Committee by Mr. Midgley, one of the chairmen of the committee of chemistry, who has had large experience in this branch of chemical manufacture. The result of this gentleman's investigation (confirmed by the experiments made by other members of the Society) is, that the ore from Shetland in quality is quite equal to that imported from America, and in richness, as far as can be judged from a few specimens, is superior.

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N° II.

GLASS HYDROMETER FOR SPIRITS.

The smaller, or ISIS SILVER MEDAL *was this Session voted to Mr.* HENRY STOKES, *of Hatton Garden, for his* HYDROMETER FOR SPIRITS. *The following communication has been received from the Candidate on the subject, and one of his Hydrometers has been placed in the repository of the Society.*

110, Hatton Garden,
March 7, 1820.

SIR;

I REQUEST, through you, to lay before the Society for the Encouragement of Arts, &c. &c., a Glass Hydrometer for ascertaining the specific gravity of spirits. This instrument will be found to possess quite sufficient accuracy for all practical purposes, is cheap, and of very easy application, as it requires the assistance neither of a book of tables, of a sliding rule, nor of weights. By means of it the value of a given spirit may be ascertained to one-fourth of a degree above or below proof; and hence I conceive it is likely to be of great service to those dealers in spirituous liquors who either object to the cost of the instruments employed by the excise and by the distillers, or who feel embarrassed in making the calculations required for the correct employment of them. The very fragility also of the material of which it is made (which by

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many may at first sight be considered as an objection to the use of it) is in fact, if duly considered, a real advantage. Accidents will occasionally occur in the use of the hydrometer as of every other instrument, either by letting it fall on the ground, or by its coming too rudely in contact with other hard substances. When this happens to a hydrometer made of metal, the ball of it being thin, will be more or less indented, and therefore, in a degree proportioned to the injury, will be rendered ever after incorrect. Many persons in the habitual use of the hydrometer are entirely ignorant of the principles on which it acts, and therefore of the injury which the slightest indentation will inflict on its accuracy, and consequently on its utility; and even those who are well aware of this will feel no small reluctance to discard an expensive instrument, unless the injury which it has received should be considerable. By the employment of the glass hydrometer, on the contrary, all sources of error arising from casual injury are effectually prevented: a slight blow, such as would, in a small degree, derange the metallic hydrometer by indenting it, will not affect the glass hydrometer on account of the elasticity of the material; and a harder blow, by breaking the instrument, puts the possessor indeed to the expense of a new one, but at the same time secures him from the errors arising from the use of a defective instrument.

The only real objection to the use of glass hydrometers is, that, as made hitherto, they have not been sufficiently comparable one with another; this is, however, entirely obviated in the instruments of my construction; three of which, differing in the length of their respective stems, accompany this communication, and which I beg leave respectfully to recommend to be put by the Committee to the test of experiment.

The graduation of the instruments is made to corres-

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pond exactly with that projected by Sikes, and at present employed by the excise. Their construction may be explained in a few words, and their use by means of an example.

Reference to the Plate of Mr. STOKES'S *Hydrometer.*

A, fig. 4, plate I, is a spherical ball, with a short tube at the bottom, connecting with a smaller bulb B, in which is contained the quicksilver requisite to bring the instrument to its real weight so as to correspond with the scale. The stem C C is about seven inches long, and contains a double scale, one D, coloured, the other E, white or plain. These scales are drawn on paper, which is introduced into the hollow of the stem, and being fixed by means of cement at the lower end, is afterwards prevented from derangement or injury by hermetically sealing the mouth of the stem. Fig. 3 represents the scale taken out of the stem, and laid on a plain surface, the shaded part representing the coloured scale. This latter is that by which the proper correction for temperature is obtained, as indicated by the small thermometer, fig. 2. The plain scale of the hydrometer shows the per-centage of the spirit above or below proof, and can be extended, if required (upward) to 70 per cent over proof, or (downward) to water. The thermometer is divided into 15 degrees more or less, and each division subdivided into halves and quarters, computed from zero or 0 upward, and from the same point downward, to the extent of the tube. The words 'add,' below zero, and 'subtract' above the same, show the number of degrees to be added to, or subtracted from the line of indication on the coloured scale of the hydrometer; such number being the variation of the temperature from the point zero, above or below, is thus used to ascertain the real from the apparent indication.

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Directions for the use of the Instrument.

Fill a glass cylinder nearly with the spirit which is to be tried, and immerse the hydrometer therein to the depth of the ball; suffer it then to sink until it find its resting point. When the instrument at length becomes quite stationary, observe what number of degrees marked on the *coloured* part of the scale within the stem corresponds with the surface of the spirit—suppose it be $27\frac{3}{4}$; place this number on a slip of paper: this done, the hydrometer is to be taken out, and the thermometer dipped into the spirit, in order to ascertain the temperature of the latter. Observe now the point or degree at which the quicksilver settles—suppose it be $2\frac{1}{2}$ *below* zero or 0; place this number down also on the slip of paper under the $27\frac{3}{4}$, and *add* them together thus: $\begin{array}{r} 27\frac{3}{4} \\ \underline{2\frac{1}{2}} \\ 30\frac{1}{4} \end{array}$, making a sum of $30\frac{1}{4}$. Look, in the next place, for $30\frac{1}{4}$ on the coloured scale, in a line with which, on the white or plain scale, will be found 18.2. This last number is the per-centage *above proof* of the spirit, and corresponds exactly with what would be determined by Sikes's hydrometer.

But suppose, secondly, the resting point of the hydrometer and corresponding surface of the spirit be 22.0 on the coloured scale; and on the hydrometer being again drawn and the thermometer immersed, that the quicksilver in the latter should stand at $2\frac{1}{4}$ *above* 0, place these two numbers down as before, and *subtract* the lower from the upper, thus: $\begin{array}{r} 22.0 \\ \underline{2\frac{1}{4}} \\ 19\frac{3}{4} \end{array}$, the number remaining indicates the strength of the spirit; which at $19\frac{3}{4}$, as in this example, is exactly of *proof strength*, as shown by Sikes's hydrometer.

Thirdly, suppose the indication or surface number of

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degrees on the coloured scale, when the hydrometer is at its subsiding point, to be 14¼, and the quicksilver in the thermometer (on its subsequent immersion) to settle at 0; it being obvious here that there is no number either to add or to subtract, a reference to the white or plain scale alone will be sufficient. The per-centage or strength of the spirit will, in this case, be indicated by that number of degrees on the plain scale which stands level with the surface of the spirit; and the strength of the latter will, in this example, be found to be 10 per cent under proof.

		s.	d.	
Price in detail	Glass Hydrometer	14	0	£.1 10s. price complete.
	Ivory Thermometer	10	0	
	Glass Cylinder . .	2	6	
	Box	3	6	

Any part of the apparatus may be replaced at the above prices.

HENRY STOKES.

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N° III.

MARINE THERMOMETER CASE.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* ROBERT JAMIESON, *Mathematical Instrument Maker, Glasgow, for a* MARINE THERMOMETER CASE. *The following communications have been received from him on the subject, and the instrument itself is placed in the Repository of the Society.*

Glasgow,
March 10, 1820.

SIR;

I BEG leave, through you, to present for the inspection of the Society, a Marine Thermometer Case which I have constructed for captain Livingston. The directions given to me by that gentleman, were, to make a case capable of preserving a thermometer from being broken when lowered into the sea, and drawn up again from the side of a ship; also, that it should admit water at any given depth, and retain it during the drawing up of the instrument, so as to enable a thermometer of the usual construction to indicate the temperature at different depths, undisturbed by the greater or inferior heat of the surface water.

The accompanying statement, drawn up by captain Livingston and confirmed by his own experience, of the utility of thermometrical observations to the navigator, renders wholly unnecessary any remarks of mine on the

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same subject. I shall therefore confine myself to the mechanical construction of the instrument as exhibited in the drawing and model herewith transmitted. In order to answer its purpose, it was necessary to combine in the construction, strength, simplicity and portability; but although these objects have been attained so as to produce a practically advantageous result, I am far from claiming for it absolute perfection. Longer experience and greater skill will probably be able to improve upon the present first attempt; and it is with this view, and also in order to call the public attention to a subject which promises to be highly beneficial to this maritime nation, that I have taken the liberty of offering the instrument to the notice and encouragement of your patriotic Society.

I am, Sir,

&c. &c. &c.

ROBERT JAMIESON.

Reference to the engraving of Mr. JAMIESON'S *Marine Thermometer Case,* Plate XV.

Fig. 5 is an exterior view of the instrument, and fig. 3 is a section of the same, with the inclosed thermometer.

The general form of the case is that of a cylinder or tube of copper, one-eighth of an inch in thickness, and seventeen inches in length; each end is open, and is bevelled off at the mouth for the more free admission of water.

v is the handle for the purpose of fixing it to the end of a cord. This handle is moveable on two pivots, by means of which it can readily be thrown on one side when it is necessary to take out or put in the thermometer.

At 2¼ inches from the top, is the circular joint *o o*, by means of which the lid forms a water-tight joint with the

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body of the case; the lid is also furnished with a hinge, on which it may be thrown back.

The valves are placed at each extremity of the tube, the upper one opening outwards, and the lower one inwards: they are composed of the following parts:

p q, a short cylinder or box, bevelled at each extremity.

s s, a bridge or cross bar, bulging at the middle, and there perforated, for the purpose of receiving an upright pin, to the upper end of which is fixed the circular plate of the valve, and to the lower end a screwed stud *t*, the round head of which prevents the pin of the valve from being drawn, by the pressure of the water, through the perforation in the cross bar.

r r, a circular projection, on which the bottom of the thermometer rests.

From this description, it is obvious that when the case containing the thermometer, and having its lid carefully closed, is dropped into the sea with a line attached to the handle, it sinks rapidly in nearly a vertical direction, and at the same time the pressure of the water throws up both the valves. In consequence of this, a current of water is constantly passing through the case while the instrument continues to sink. As soon, however, as by the check of the cord the instrument becomes stationary, the valves fall into their places, and intercept the escape of the water; the quicker the cord is drawn up, the more completely are the valves secured, and the influx of the upper water the more perfectly prevented. As soon as the case comes to hand, the lid is to be thrown back and the thermometer withdrawn just sufficiently to enable the observer to read off the degree at which the mercury stands.

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44, Adelphi-street, Hutcheson Town, Glasgow,
February 25th, 1820.

DEAR SIR;

As I understand you have advised Mr. Jamieson, mathematical instrument maker of this city, to submit the model of the Marine Thermometer Case constructed by him, for my use, to the notice of the Society for the Encouragement of Arts, &c., &c., and that you have expressed a wish to have a written statement of the causes which led to my application to Mr. Jamieson, in consequence of which, he was led to undertake the construction of that instrument, and also of my opinion of its utility for nautical purposes, I shall endeavour to comply with your wishes as concisely as in my power; though I am much afraid the detail into which I must necessarily enter, will not admit of all the brevity which might be desirable.

My attention was first directed to the thermometer, as a valuable nautical instrument, by the excellent memoir compiled by Mr. John Purdy, hydrographer, London, to accompany the admirable Chart of the North Atlantic Ocean, constructed by him, and published by Messrs. Whittle and Laurie, of 53, Fleet-street, in the year 1812.

The late celebrated Dr. Benjamin Franklin, was, I believe, the first person who suggested the utility of the thermometer as an indicator of the *proximity of*, or an *approach to*, the American coast, having remarked the great difference of temperature between the water of the Gulf stream as it sweeps along the coasts of the United States, and the water upon the soundings between the inner edge of the stream and the shore.

This interesting subject was afterwards taken up by colonel Jonathan Williams, who endeavoured, with some success, to attract the attention of nautical men to the vast importance of the thermometer, in an ingenious work

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intituled "Thermometrical Navigation," published at Philadelphia, in 1799.

To avoid unnecessarily extending the length of this letter, by quoting evidence already before the public, I beg to refer to the third edition of the Memoir by Mr. Purdy, already mentioned, the perusal of which must satisfy the most sceptical, that the thermometer is not only a certain indicator of the proximity of the American coast, but also an infallible monitor of an approach to islands of ice, so perilous to navigators, and the dangers of which are tenfold increased by the circumstance of their being generally surrounded by dense fogs. Mr. P.'s Memoir, from the 73rd to the 78th page, is occupied with these important subjects.

Colonel Williams recommends that the thermometer should be slung, "so as to tow in the dead water of the ship's wake." I tried this mode, and had three of my thermometers broken in consequence; *this* led me first to think of having a case to prevent my instruments from being fractured by any accidental contact with the ship. Some gentlemen, whose opinions I respected, suggested that while towed by the ship, her way through the water would naturally cause the thermometer to rise to the surface, and that thus only the temperature of the surface water could be obtained, and that they conceived this temperature liable to be influenced by the effects of the solar rays. To obviate this objection, I saw the necessity of a case to inclose the thermometer, which would admit the water freely as long as it was permitted to descend, but would shut as soon as it was begun to be hauled up.

After I was satisfied how useful a thermometer case, adapted properly for these purposes, must prove, I applied to various mechanics in different places to construct one

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for me, but they either did not sufficiently understand the matter, or considered the safety of human lives and merchants ships and cargoes of too trivial importance to induce them to exercise their abilities; be this as it may, I was always disappointed of my object, until I became accidentally acquainted with Mr. Jamieson, who readily entered into my views, and made a case for my thermometer, which completely answers my ideas, of which the model intended to be sent to the Honourable the Society of Arts, &c. is, as you know, a correct copy, *i. e.* allowing for the difference of sizes, the original case being $1\frac{5}{10}$ inch in diameter within, which I consider large enough to contain a column of water that will retain its original temperature a sufficient space of time (after the case is hauled up), to allow of the degrees indicated by the scale being read off by the observer, which is all that is necessary; while, if the magnitude of the apparatus had been increased, it must have become almost useless from its weight, when a vessel had fresh way through the water, and by the time she came to run eight or nine knots, must have been totally unserviceable. The same objection applies to any addition of weight.

The objection to Jamieson's Marine Thermometer Case, which has I understand been made, that the valves do not permit a sufficient column of water to pass completely to fill the interior of the case in a constant stream as it descends, appears to me of little importance, as enough must pass through to regulate the altitude of the mercury in the thermometer tube, and before there can possibly be time to haul up any part of the attached line, the mere pressure of the water must infallibly fill the thermometer case.

Purdy's Memoir shows incontestibly that no vessel on board of which there is a thermometer, can possibly run ashore on the coasts of the United States of America to the northward of the Strait of Florida, without her com-

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mander (unless he is guilty of the most culpable negligence) having at least warning in sufficient time to avoid the danger (*i. e.* if his vessel is not so much crippled as to render it impossible for him to use any means to get off shore); and various circumstances induce me to hope that the thermometer will ultimately be found not only an indicator of an approach to the coasts of the United States, but also, that it will point out the proximity of land or soundings in *all* places to the northward of the Tropics, and probably also to the southward of them, though my own experience does not warrant me in the hope that it will within them.

Besides these advantages, the use of the thermometer has already been ascertained as illustrative of several of the oceanic currents. The venerable and indefatigable geographer, major Rennell, in a letter to myself dated 6th of November last, observes, "*The current from the Indian Ocean round the Cape of Good Hope differs* 10° *from the Ocean water*, i. e. *is* WARMER; *the* EQUATORIAL CURRENT *colder by* 5 *or* 6 *deg. than the Guinea current, which* BRUSHES *it in passing, &c.*" Thus far already established. We may surely venture to hope that as thermometrical observations are multiplied, their utility will become more obvious, and be more generally acknowledged.

In my own experience I have found a difference of 12 deg. in the temperature of the water in a few hours. Running out of the Delaware, in 9 fathoms water, the mercury stood at 60 deg. (in October 1817); as the water deepened, it rose to 64 deg.; and as we entered into the Gulf stream, it suddenly increased to 72 deg.

In September 1818, when bound from New Orleans to Gibraltar, in the ship Asia, of Scarborough, then under my command, a fever broke out on board the ship, and for a considerable number of days after we cleared the Strait of Florida, we had only four men and a boy fit for duty,

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and three out of that number merely convalescents. I was myself confined to bed, and my mate in the same situation; we were the only two navigators on board, and both unable to make up any reckoning, and some days unable even to crawl on deck to take an observation at noon. In this dilemma I trusted entirely to my thermometers, having given orders that the instant the mercury fell two or three degrees, the ship's head should be wore round off shore. In this way I kept the ship from danger, and also availed myself of the Gulf stream current to carry us to the northward, and I really believe that under Divine Providence, the safety of the ship, cargo, and crew, was attributable to my thermometers.

On the same voyage, on approaching very near the Azores Islands, the mercury sank 2 deg., and when we made the coast of Portugal, it rapidly fell from 69 deg. to 61 deg., at which it stood when we rounded Cape St. Vincent, at the distance of about a league. After we passed that promontory, the mercury again rose to 69 deg., at which it continued until the ship entered the Strait of Gibraltar. In the Strait the wind was adverse; and in beating through it, the mercury stood at 68 deg. in the middle of the Strait, 64 deg. on the Spanish shore, and 61 deg. on the African coast: this difference between the temperature on the Spanish and African shores is apparently easily accounted for, as we stood much closer to the latter, avoiding the former on account of the rocks and shoals to the westward of Tariffa; yet as we found the mercury at our anchorage in Gibraltar Bay stood at 64 deg., perhaps there really was a difference of temperature in the water on the opposite shores: this was in October, 1818. Major Rennell, to whom science is under so many obligations, has communicated to me, that captain Beaufort, of the Royal Navy, found a difference of 10 deg. between the water in the middle of the Strait and

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that in Gibraltar Bay, but I am not aware at what season Captain Beaufort's experiments were made.

Since Mr. Jamieson completed the thermometer case for me I carried it down to Greenock, and exhibited it to Mr. Colin Lamont, Mr. Quintin Leitch, and Mr. William Heron. Mr. Leitch procured a boat, and we went off, and made a number of experiments, which proved completely satisfactory.

My opinion of Jamieson's Marine Thermometer Case is, that the simplicity of its construction, and its strength, render it as complete a thing as could be desired for the purpose for which it is intended. I fully concur in the opinion expressed in the certificate by Messrs. Lamont, Leitch, and Heron; and I am decidedly of opinion that either to increase the size, or to add lead to it to increase the weight, will never be proposed by any practical seaman.

The mode in which I propose to use the apparatus is, by making about 20 fathoms of strong line fast to it,—to cause the officer of the watch to stand aft with the end of the line made secure to one of the staunchions, or some other thing, lest it should accidentally slip through his hands, and the whole be lost; he must then cause the apparatus to be passed forward, as in heaving the deep sea lead: when the vessel has much way through the water, it may be passed to the bowsprit end, and dropped (not hove) from it; but for general use the fore-chains may be far enough: when all is ready, let the officer call out to *let go*, and when that is done he must immediately haul in the line, and when he gets hold of the case, open it, and draw out the thermometer a sufficient length to read off the altitude of the mercury indicated by the scale, which he ought immediately to mark on the log slate, in a column which should be traced upon the slate for the purpose.

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In my own practice I have always caused two columns to be marked, the one T. A. for temperature of the air, the other T. W. for temperature of the water. In these columns I ordered the officer of the watch to insert the temperature both of the air and water twice (sometimes oftener) each watch. The temperature of the air is, however, of little importance farther than as a comparative observation, it being only the variations of temperature in the water which are of importance to the navigator.

In reading off, the observer should take care to keep as much of the thermometer as possible immersed in the water, which this marine case allows of being done with facility.

I have said enough to convince you of the immense importance of the thermometer as a nautical instrument, and that Mr. Jamieson's Marine Case renders the use of it both more easy and certain.

I am, Sir,

William Warren, Esq. ANDREW LIVINGSTON,
Shipmaster.

P. S. You are at perfect liberty to use this letter in any mode you think may be advantageous to Mr. Jamieson, whom I consider entitled to much credit for this simple and useful invention. A. L.

2nd P. S. Since writing the above, Mr. Jamieson has informed me that he is anxious to send the instrument with which the experiments were actually made at Greenock, and begged me to let him have it, promising to replace it to me; although with some reluctance I have complied, thus the Society of Arts will actually have the real marine thermometer case in place of a model; and I doubt not but the scientific members of that honourable body, will neither wish its size or weight increased, whatever individuals (here) ignorant of seamanship may say. A. L.

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N° IV.

IMPROVED GLAZE FOR PORCELAIN.

The smaller or ISIS GOLD MEDAL *was this Session voted to Mr.* JOHN ROSE, *of Coalport, Shropshire, for an* IMPROVED GLAZE FOR PORCELAIN. *The following communication on the subject has been received from the candidate, and specimens of the Felspar, the principal ingredient of the Glaze, of the entire glaze ready mixed for use, and of the Porcelain in a finished state, have been placed in the Society's Repository.*

Coalport,
March 24th, 1820.

SIR;

HAVING for some time made use of a glaze for porcelain, which gives me great satisfaction, and into the composition of which, neither lead nor arsenic are admitted, I beg leave to submit the same to the consideration of the Society of Arts, &c.

The common glaze for porcelain and the finer kinds of earthenware contains a considerable proportion of glass of lead; this ingredient however, on account of its being mixed with a certain proportion of siliceous earth and other vitrefiable materials, unites with them into a glass, which although easily fusible, is not in the least corroded or acted on by any articles of food. It is not, therefore, from the apprehension of any injury to the health of those who use vessels of porcelain, that the use of lead in the

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glaze is objectionable, but because it is extremely liable to combine with, and degrade the more delicate colours, especially those given by preparations of chrome and of gold. This is particularly the case in the more expensive and elaborate products which, on account of the multiplicity of their colours, require to be repeatedly heated, or *fired*. I trust, therefore, that the Society will consider the communication of a receipt for glazing, in which the above mentioned defects are avoided, as worthy of their favourable notice.

The principal ingredient of my glaze is felspar, of a somewhat compact texture, and a pale flesh red colour, which forms veins in a slaty rock adjoining to the town of Welsh Pool, in Montgomeryshire. This material being freed from all adhering pieces of slate and of quartz, is ground to a fine powder, and being thus prepared, I mix with 27 parts of felspar, 18 of borax, 4 of Lynn sand, 3 of nitre, 3 of soda, and 3 of Cornwall China clay. This mixture is to be melted to a frit, and is then to be ground to a fine powder, 3 parts of calcined borax being added previously to the grinding.

The specimens accompanying this letter, are,

1. The felspar in its rough state.
2. Do. ground to a fine powder.
3. Some of the glaze ready prepared for dipping.
4. Specimens of porcelain glazed.
5. Do. both glazed and afterwards painted, in order to show the solidity and brilliancy of the colours when used on this glaze.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN ROSE.

Some of the specimens furnished by Mr. Rose were placed by the committee in the hands of Mr. Muss, and of

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other artists, in order to be submitted to experiment both with regard to the perfection of the glaze itself at high temperatures, and its re-action on the several colouring materials.

Mr. Muss's trial pieces were proved first in a common kiln, and afterwards were subjected to the action of a much higher degree of heat than it is possible that they can ever be exposed to in the fair course of enamelling. In this extreme heat the ground of the ware is not in the least degree softened or affected; the glaze remains firm and perfectly uniform without any specks or spits having been produced on its surface; the colours, even the pinks and chrome greens, come out remarkably well upon it. Mr. Rose's glaze not being so hard as that used by the French manufacturers, incorporates more completely with the colours, and renders them perfectly firm, whereas, every artist knows that colours laid on French porcelain are extremely apt to chip off, crackle, and flake, if it is necessary to make them pass the fire a second time. On the whole, therefore, Mr. Muss considers the samples placed in his hands by the committee, as the best both in body and glaze that have ever come under his observation.

Similar reports of the excellency of the glaze, in the particulars above mentioned, were made by the other artists who had made trial of it.

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PAPERS

IN

POLITE ARTS.

N° I.

PARALLEL RULE.

The smaller, or ISIS SILVER MEDAL *of the Society was this Session voted to Mr.* ARTHUR HARRISON, *of Charlotte Street, Rathbone Place, for a* PARALLEL RULE *for the use of Engravers. The following communication has been received from the candidate, and the Instrument is placed in the Society's Repository.*

4, Charlotte Street, Rathbone Place,
November 2, 1819.

SIR,

I REQUEST that you will lay before the Society of Arts, &c. &c., the accompanying parallel rule which I trust will be considered as deserving of their favourable notice. It will be found in use to allow the hand of the artist to traverse freely from one side to the other without the interruption experienced in those of the common construction by the projection of the brass pieces on which their movements depend. The greater regularity of the

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lines thus produced, although an important advantage to the draftsman, will, I trust, prove of especial use to the engraver, in whose works perfect precision of execution is indispensable. A farther advantage is, that rules of this construction are but little liable to be deranged by an accidental blow or fall, or to warp by heat or cold, by moisture or dryness.

The rule may be made of any length, without increasing its thickness, ¼ of an inch in each of the external plates being quite sufficient for securing the rivets. The movement may be either single or double, according to the use to which the instrument is to be applied.

I am, Sir,

Arthur Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. ARTHUR HARRISON.

References to the engraving of Mr. HARRISON'S *Parallel Rule,* Plate V.

Fig. 7, a view of the rule in its entire state.

Fig. 8, a sectional view, in which the three parallel plates of which it is composed are separated from each other; *r*, the middle plate; *q s*, the two outer ones.

Fig. 9 shows the brass hinges of the rule, after the upper plate and half of the middle plate have been removed; *q*, the under plate; *r*, half the middle one.

Fig. 10 shows the form given to each half of the middle plate in order to receive the hinges.

Fig. 11, the outside of half the upper or lower plate, in which is a semi-circular depression to receive the tip of the finger, and thus to move the rule forward or backward.

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N° II.

PREVENTION OF FORGERY.

The Thanks of the Society were this Session voted to Messrs. PERKINS, FAIRMAN, *and* HEATH, *for their very liberal offer of communicating to the Society for publication in the ensuing Volume of Transactions, certain parts of their* SIDEROGRAPHIC *process for multiplying copies of engravings, particularly with a view to the* PREVENTION OF FORGERY. *The following communication has been received in consequence from the above-mentioned gentlemen.*

SIR;

THE Society for the Encouragement of Arts, Manufactures, and Commerce having devoted so much of their valuable time to investigating the different methods proposed for the prevention of the forgery of Bank notes, we, the proprietors of the Siderographic art, believe that a full account of our plan (which has been in successful operation many years in America, and is now adopted by many banks in this country) will not be thought unworthy of their attention.

We will, in the first place state what we consider to be the grand basis of *security* in this plan, and secondly, the means of executing it. Although it is certainly not a new idea, that the greatest security which could possibly be afforded in preventing forgery would be that of employing

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a combination of the talents of the first-rate artists in fabricating a bank note plate, and of having the notes always *identically* the same; yet we conceive the following plan to effect this object is entirely new. It is the power of re-producing and multiplying the works of the greatest artists, which constitute the strength of this system; it is the basis on which we build our hopes. The method of multiplying engravings is as follows:

A steel plate (the method of preparing which will be hereafter described), is engraved or etched in the usual way; it is then hardened. A cylinder of very soft steel, of from 2 to 3 inches in diameter, is made to roll backwards and forwards on the surface of the steel plate, until the whole of the impression from the engraving is seen on the cylinder in alto-relievo: after this cylinder has been hardened, it is made to roll backwards and forwards on a copper or soft steel plate, and a perfect fac-simile of the original is produced of equal sharpness. The following calculations will show to what extent this system of preventing forgery may be carried.

Suppose 20 of the best historical and other engravers were employed, each to engrave a vignette; each vignette to occupy 4 square inches, and each artist to expend 6 months on his vignette: let these 20 vignettes be transferred to two steel plates, one for the front of the note, and the other for the back; the result will be, that one man (could such an one be found) would be occupied 10 years, or 20 men 6 months, to produce a note of equal goodness. Is it possible to suppose any thing better can be adopted, than to make it unprofitable to be engaged in such business? If a bank note plate can be made to cost 10,000*l.* (which would be the case, if 20 artists, whose time would be worth 1,000*l.* per annum, were engaged 6 months each), would it not be much less likely to be imitated than one that would cost but 5 or 10*l.*? If a bank plate

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can be made to contain the work of 20 of the best artists in the world, could another plate of equal goodness be made without employing the same artists? It is hardly to be presumed that 20 such artists would be engaged in making a spurious note; but admitting it possible, it would not be a fac-simile, and might be easily distinguished from the true note, by any one acquainted with the original. One of the peculiar features of this invention is, that any one may be furnished with a perfect fac-simile of the whole or of any part of the original note; which will serve to identify the note if good: this is owing to the infinite number of impressions that may be obtained from the original engraving. Having shown that a plate may be made to cost 10,000*l.*, we will undertake to prove that it is not incompatible with economy. To show the economy of this plan in its best light, we must be allowed to apply it to the best advantage, which would be by its being adopted by a bank whose daily consumption is not less than 25,000 notes.

Suppose the first steel plate costs 10,000*l.*, the next 999 plates will only cost 10,000*l.*: then 1,000 steel plates will amount to 20,000*l.* Each steel plate will print at least 150,000 impressions; of course 1,000 plates would furnish 150,000,000 of impressions, which is the number that would be wanted in 20 years, at 25,000 impressions per day. Now, the cost of impressions from steel plates would be (where the above number is wanted) one penny for 31¼ impressions; whereas, if copper plates were used, which cost only 3*l.* each plate, the number of impressions for a penny would be but 8$\frac{1}{3}$, since a copper plate prints but 6,000 impressions before it is worn out.

Another very important consideration is, that steel plates admit of an improved method of printing, and when worked to the greatest advantage, will make a saving of 50 per cent; this saving, in 20 years, in printing the

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above number of notes would be 75,000*l.* which would not only pay the whole cost of making the plates, but leave a balance of 55,000*l.*

This system of making plates and of printing, will apply equally well to that of ornamenting standard works, particularly bibles, prayer books, primers, catechisms, spelling books, natural history, and philosophy. In proportion to the number wanted, will be the advantage of adopting this plan. It is often the case in this country, that from 4 to 6 copper plates are worn out in one edition, and not half the impressions perfect. A hardened steel plate will print more *proof impressions* than the above number of copper plates can furnish, even of common impressions. This fact is demonstrated by the plates Nos. XXXIX and XL, accompanying this communication. The impressions from plate No. XXXIX, are of the first impressions taken from the plate. The impressions, plate No. XL, were taken after 35,000 impressions had been taken from it.

This plate will also show the practicability of identity. The four medallions by inspection will be found to be perfectly the same, *line for line and dot for dot*. By examining the machine engraving, particularly the chain; the two *styles* of work, viz. copper plate and letter-press printing will be seen beautifully combined. This is effected by the process of transferring and re-transferring. This kind of engraving is extremely difficult to imitate. This machine, which is denominated the geometrical lathe, was invented in America by Mr. Asa Spencer. Its powers for producing variety are equalled only by the kaleidoscope; but for beautiful patterns it surpasses every thing of the kind. It has one of the peculiarities of the kaleidoscope, viz. that the turning of a screw, like the turning of the kaleidoscope, produces an entire new pattern, which was never before seen, and perhaps would never be seen again.

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This pattern however may be perpetuated by the transferring process. We are now printing from a plate of the most delicate work, which has already printed above 100,000 impressions, and is yet sound. We cannot yet say, how long a well hardened steel plate will last, having never printed more than 500,000 impressions from the same plate: it should however, be observed, that this plate consisted principally of writing, or work quite as strong. It may also be observed, that the impressions are yet good. The manufacture of printed calicoes, ribbons, &c., as well as of earthenware, may be much improved by adopting this system; and we are happy to say that experiments are soon to be made thereof. This improvement in engraving will apply to about one quarter of the present number of plates used. The others must necessarily be of copper, as a sufficient number of impressions would not be wanted to defray the expense of a steel plate. Not less than a number of impressions which would wear out three copper plates would warrant the making a steel plate. But such is the number of subjects to which this art will apply, and the great inducement to publishers to embellish their works, where large editions are wanted, which they now can do in consequence of its economy, that instead of the demand of engravers being lessened, it will be very much enhanced.

The use of fine and delicate engraving for Bank notes, has been objected to, in consequence of the difficulty of printing on such highly sized paper. But this objection is entirely got over by our method of printing in the water leaf, and sizing after printing. This improvement has a triple advantage,—that of producing beautiful impressions, having on its surface, after printing, a better size, and preventing the ink from being so easily transferred.

In order to describe the method of preparing and

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hardening the steel plate and dies, the following particulars are necessary:

In order to decarbonate the surfaces of cast steel plates, cylinders, or dies, by which they are rendered much softer and fitter for receiving either transferred or engraved designs, we use pure iron filings, divested of all foreign or extraneous matters.

The stratum of decarbonated steel should not be too thick for transferring fine and delicate engravings; for instance, not more than three times the depth of the engraving: but for other purposes the surface of the steel may be decarbonated to any required thickness.

To decarbonate it to a proper thickness for fine engravings, it is to be exposed for four hours in a white heat, inclosed in a cast iron box, with a well closed lid. The sides of the cast iron box are made at least three quarters of an inch in thickness; and at least a thickness of half an inch of pure iron filings should cover or surround the cast steel surface to be decarbonated. The box is to be suffered to cool very slowly, which may be effected by shutting off all access of air to the furnace, and covering it with a layer six or seven inches in thickness, of fine cinders. Each side of the steel plate, cylinder, or die, must be equally decarbonated, to prevent it from springing or warping in hardening. It is also found that the safest way to heat the plates, cylinders, or dies, is by placing them in a vertical position.

The best cast steel is preferred to any other sort of steel for the purpose of making plates, cylinders, circular or other dies; and more especially, when such plates, cylinders, or dies are intended to be decarbonated. For the reason given above, the steel is decarbonated, solely for the purpose of rendering it sufficiently soft for receiving any impression intended to be made thereon; it is therefore necessary that, after any piece of steel has been

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so decarbonated, whether it be in the shape of a plate, or a cylinder, or a die, it should, previously to being printed from, be again carbonated, or re-converted into steel capable of being hardened. In order, therefore, to effect this carbonization or re-conversion into steel, the following process is employed:—a suitable quantity of leather is to be converted into charcoal by the well-known method of exposing it to a red heat in an iron retort, for a sufficient length of time; or, until most of the evaporable matter is driven off the leather. Having thus prepared the charcoal, it is reduced to a very fine powder; then take a box made of cast iron, of sufficient dimensions to receive the plate, cylinder, or die, which is to be re-converted into steel, so as that the intermediate space between the sides of the said box, and the plate, cylinder, or die, may be about one inch. This box is to be filled with the powdered charcoal, and having covered it with a well fitted lid, let it be placed in a furnace similar to those used for melting brass, when the heat must be gradually increased, until the box is somewhat above a red heat; it must be suffered to remain in that state till all the evaporable matter is driven off from the charcoal. Then remove the lid from the box, and immerse the plate, cylinder, or die, into the powdered charcoal; taking care to place it as nearly in the middle as possible, so that it may be surrounded on all sides by a stratum of the powder, of nearly an uniform thickness. The lid being replaced, the box, with the plate, cylinder, or die, must remain in the degree of heat before described, for from three to five hours, according to the thickness of the plate, cylinder, or die so exposed. Three hours are sufficient for a plate of half an inch in thickness; and five hours when the steel is one inch and a half in thickness. After the plate, cylinder, or die has been thus exposed to the fire for a sufficient length of time, take it from the

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box and immediately plunge it into cold water. It is important here to observe, that it is found by experience that the plates or other pieces of steel when plunged into cold water, are least liable to be warped or bent when they are held in a vertical position, or made to enter the water in the direction of their length. If a piece of steel, heated to a proper degree for hardening, be plunged into water, and suffered to remain there until it becomes cold, it is found by experience to be very liable to crack or break; and, in many cases, it would be found too hard for the operations it was intended to perform. If the steel cracks or breaks, it is spoiled. In order to render it fit for use, should it happen not to be broken in the hardening, it is the common practice to heat the steel again, in order to reduce or lower its temper, as it is technically called. The degree of heat to which it is now exposed determines the future degree of hardness, or the temper, and this is indicated by a change of colour upon the surface of the steel. During this heating a succession of shades is produced from a very pale straw colour to a deep blue. It is found, however, by long experience, that on plunging the heated steel into cold water, and suffering it to remain there no longer than is sufficient for lowering the temperature of the steel to the same degree as that to which a hard piece of steel must have been raised, in order to temper it in the common way; it not only produces the same degree of hardness in the steel, but, what is of much more importance, almost entirely does away the risk or liability of its cracking or breaking. It is impossible to communicate by words, or to describe the criterion by which we can judge of, or determine, when the steel has arrived at the proper degree of temperature, after being plunged into cold water; it can only be learned by actual observation, as the workman must be guided entirely by the kind of hissing or singing noise,

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which the heated steel produces in the water while cooling. From the moment of its being first plunged into the water, a varying sound will be observed; and it is at a certain tone before the noise ceases, that the effect to be produced is known. The only directions which can be given, whereby the experimentalist can be benefitted, are as follow: namely, to take a piece of steel which has already been hardened by remaining in the water till cold; and, by the common method of again heating it, to let it be brought to the pale yellow, or straw colour, which indicates the desired temper of the steel plate to be hardened by the above process; as soon as he discovers this colour to be produced, to dip the steel into water and attend carefully to the hissing, or, as some call it, singing noise, which it occasions; he will then be better able, and with fewer experiments, to judge of the precise time at which the steel should be taken out. It is not meant to be understood that the temper indicated by a straw colour, is that to which the steel plate, cylinder, or die, should be ultimately reduced; because it would then be found too hard; but merely that the temperature which would produce that colour, is that by which the peculiar sound would be occasioned when the steel should be withdrawn from the water for the first time. Immediately on withdrawing it from the water, the steel plate, cylinder, or die, must be laid upon, or held over a fire, and heated uniformly, until its temperature is raised to that degree at which tallow would be decomposed; or, in other words, until smoke is perceived to arise from the surface of the steel plate, cylinder, or die, after having been rubbed with tallow. The steel plate, cylinder, or die, must then be again plunged into water, and kept there until the sound becomes somewhat weaker than before. It is then to be taken out, and heated a second time to the same degree, by the same rule of smoking tallow as before; and

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the third time plunged into water, till the sound becomes again weaker than the last. Expose it a third time to the fire as before; and, for the last time, return it into the water and cool it; after it is cooled, clean the surface of the steel plate, cylinder, or die; and by heating it over the fire, the temper must be finally reduced by bringing on a brown, or such other lighter or darker shade of colour, as may best suit the quality of the steel, or the purpose to which it is to be applied.

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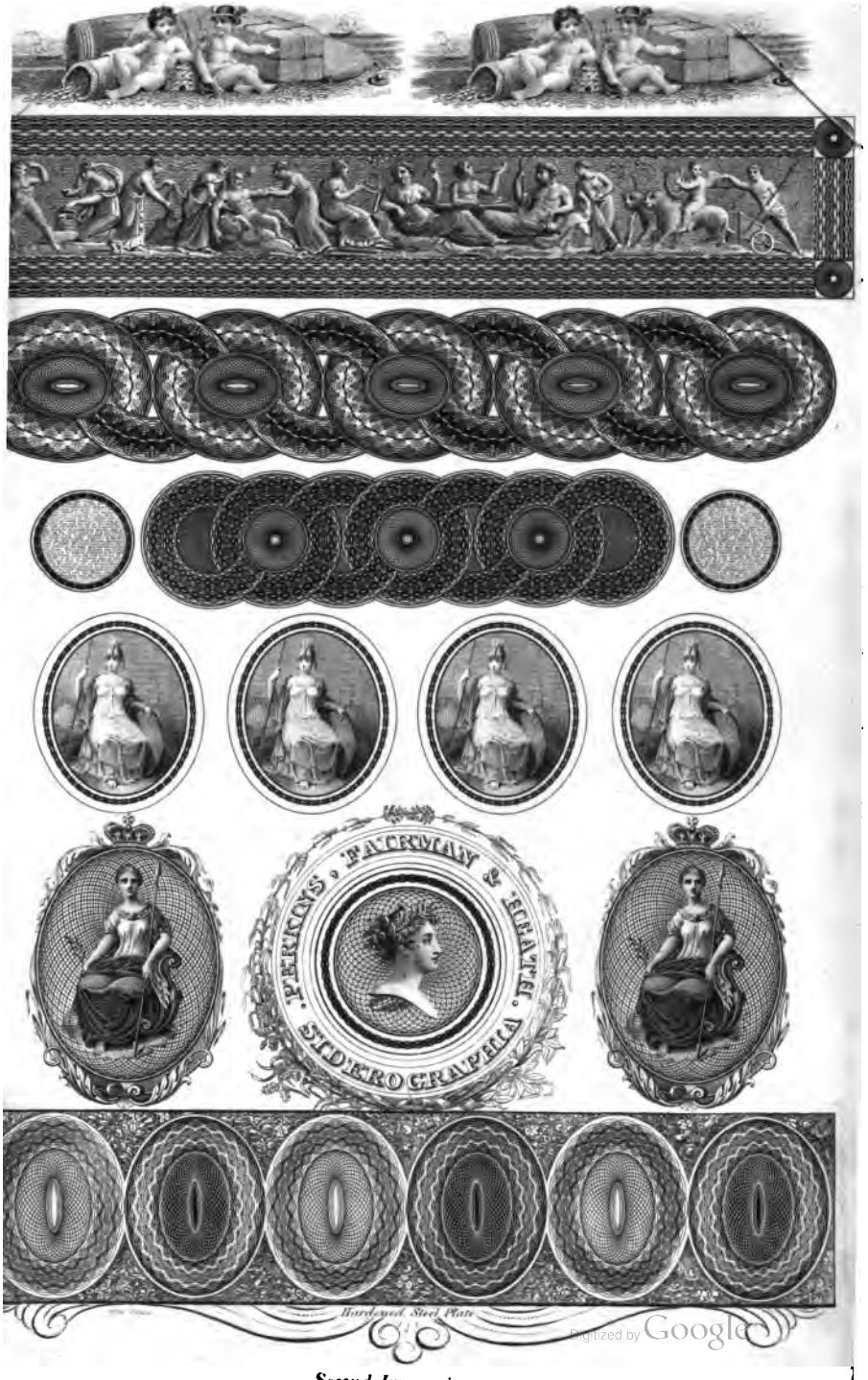

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Second Impression.

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PAPERS

IN

MECHANICS.

N° I.

IMPROVED SERVICE PIPE FOR CISTERNS.

The sum of FIVE GUINEAS *was this Session presented to Mr.* WM. BULLOCK, *Star Court, Compton Street, Soho, for an* IMPROVED SERVICE PIPE FOR CISTERNS. *The following communication has been received from him on the subject, and one of the Instruments is placed in the Society's Repository.*

3, Star Court, Compton Street,
Soho, March 29, 1820.

SIR;

I HEREWITH send for the judgment of the Society of Arts, &c., an improved water service for cisterns, in which the floating ball, instead of being attached to a stop cock, as is the usual practice, is made to open and shut a valve of very simple construction. By the substitution of a valve instead of a stop cock the waste of water and accidents arising from the stiffness and corrosion of the latter are entirely avoided, and a much freer passage is allowed to the water.

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The inspection of the instrument will at once explain its construction and mode of action.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. WILLIAM BULLOCK.

Reference to the Engraving of Mr. BULLOCK'S *Ball Valve for Cisterns,* Plate I.

Fig. 4 is a view of the entire instrument tapering at its upper extremity, by which it is inserted into the service main. A fulcrum is formed by a bent arm projecting from the outside of the orifice through which the water is discharged; and upon this fulcrum the rod or lever of the floating ball traverses by means of two swivels or points (shown particularly in fig. 8), which work in two shallow holes, one on each side of the fulcrum. The extremity of the short arm of the lever raises the valve up, and thus allows the discharge of the water into the cistern. When the cistern is sufficiently filled to float the ball, the lever ceases to press the valve up: in proportion as the ball rises, the valve descends, and when the rod has reached the position represented by the dotted lines, it ceases to be in contact with the valve, and of course this latter closes the discharging pipe, and is retained in its position both by its own weight, and by the pressure of the water in the main.

Fig. 5 is a section showing more particularly the figure of the valve and its situation.

Fig. 7 shows the orifice of the discharging pipe, with the ring in its center, within which the stem of the valve works, and which prevents the valve from being displaced.

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Fig. 6 is a view at right angles to fig. 4, showing particularly the form of the end of the bent arm, which serves as the fulcrum to the lever.

N° II.

STRIKING PART OF A CLOCK.

The large SILVER MEDAL *of the Society and* TWENTY GUINEAS *were this Session voted to Mr.* JOHN PRIOR, *of Nessfield, near Skipton, for the* STRIKING PART OF A CLOCK. *The following communication has been received from the candidate, and a Model of his Invention is placed in the Society's Repository.*

Nessfield, near Skipton,
December 18, 1819.

SIR;

I BEG you will have the goodness to lay the accompanying model of the striking part of a Clock before the Society of Arts, &c. &c., for their inspection and decision. Its construction is so obvious that I need not say much on that subject, as the Committee will perceive the mechanism of it at first sight.

Before this machine is put in action, it should be set upright, in which position the pendulum, or, which is the same thing, the hammer, when at rest will hang in a line with the pedestal. This being properly adjusted, wind upon the barrel the cord which bears the weight, and disengage the detent, when the pendulum will strike the hour on the bell.

This apparatus may be connected in the usual way with

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the train of a clock, or it may be adapted to a common watch in the following manner:—

Take off the outer case of the watch, if it has any; throw back the glass, and lay the watch with the face upwards upon the circular plate of brass fixed in front of the instrument, and which may be raised or lowered according to the thickness of the watch. The watch being in this position, and having the axis of its minute hand concentric with the vertical axis of the machine, which carries a plate with 60 divisions, screw the sliders fast which inclose the watch. Then raise or lower the plate on which the watch rests till the notch of ivory embraces the minute hand, and screw it fast in this position. Lastly, hold the upright axis firmly with one hand, and with the other turn the minute plate till the divisions on it coincide with those on the face of the watch. The machine will now strike the hours according as they are indicated by the watch.

I am, Sir,
&c. &c. &c.
JOHN PRIOR.

A. Aikin, Esq.,
Secretary, &c. &c.

Reference to the Engraving of Mr. JOHN PRIOR'S *striking part of a Clock,* Plate II.

Fig. 1 is a side view, and Fig. 2 a bird's-eye view of the machine: *a*, the weight; *b*, the barrel on the axis of the escape wheel; *c*, the ratchet wheel; *d*, the escape wheel of 78 teeth, this is also the count wheel, the pins being in the rim as at *e e*; *f*, the pallets; *g* and *h*, the pendulum rod and ball, which is also the hammer; *i*, the bell, placed oblique enough to let the hammer clear it on one side, and only strike it on the other; *k*, the detent; this detent is raised by the spring *l l* striking against the slope stud *m*,

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of the detent arm; fig. 3 shows the spring *l* separate; it has an arm *n*, projecting through the plate *p p*; the snail *q* in every turn presses against this arm, and raises the spring, as shown by the dotted lines, and, on the snail passing, the spring *l*, aided by its weight *r*, strikes beyond its place of rest, and by the tooth *o*, fig. 4, raises the detent stud *m*; *s* is a pin to keep it from rising too high; *t* is a guide pin fixed in the plate *p p*, and standing through the forked end of the spring *l*; *v* is a minute plate fixed under the snail *q*, and moving stiffly on the axis *w* by means of a spring fixed below it; on this axis is fixed a short hollow cylinder of ivory *x*, with a notch in it; *y*, fig. 2, is an index by which the minute plate is set to the same time as the watch which is to be secured in the watch-holder *z z*, in such a manner that the axis of the minute hand is under the axis *w*; then raise the watch-holder till the minute hand goes into the notch of the cylinder *x*, and fix it by the screw 1: the minute hand will then carry round the snail *q*, and thereby strike the hours: 2 is the counter string to wind it up; 3 an additional ball which may be screwed on the top of the pendulum to make it strike slower.

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N° III.

IMPROVED METHOD OF CONSTRUCTING ROOFS.

The large SILVER MEDAL *of the Society was this Session voted to* A. H. HOLDSWORTH, *Esq., of Dartmouth, for an* IMPROVED METHOD OF CONSTRUCTING ROOFS. *The following communication has been received on the subject, and Models of the Invention are placed in the Society's Repository.*

15, Manchester Buildings, Westminster Bridge,
April 26, 1820.

SIR;

THE two models which I send herewith to the Society of Arts, &c. for their inspection, are of the timbers of a roof which covers a building one hundred feet long by thirty-seven feet wide; and as the whole was constructed under my direction, and appears to possess many advantages over the usual method of framing roofs, I am desirous of submitting them to the judgment of the Society, in order that (if approved) they may be offered to the acceptance of the public through the medium of the Transactions of the Society.

The advantages which this method affords are the saving of a considerable proportion of the timber usually employed, and the gaining for useful purposes the whole space that is contained within the roof.

I have also constructed for a friend a roof of the same kind placed over his dwelling house, so that, with walls

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only six feet above his upper floor, he gets high rooms, whilst on the outside his house appears very low: his barns, haylofts, &c., are built on the same plan.

The mode in which I have constructed these roofs is as follows: A A, Plate III, fig. 1, being the walls of the house, and B one of the timbers of the uppermost floor, resting on sleepers *f f*, let into the wall, I fix two pieces of wood D D, on the top of the wall, resting also on sleepers *f f*. The principals C C, forming each pair, are then secured at the bottom into the pieces D D, and are fastened to each other at the top by iron pins. Each pair of principals is supported by two arch pieces E E; these pieces are *in their grain*, and are formed on the plan recommended by Mr. Hookey of the King's-yard at Woolwich, to whom the country is so much indebted for this method of converting timber. They are cut lengthways by a saw into three pieces, to within two feet of one end, are then placed in a steam kiln, and boiled until they will bend freely, when they are fixed to a mould and left to cool, after which a few pins of wood are driven through them to keep the pieces so cut from again flying open. The arch pieces will get a little out of place when taken from the mould, but will easily be brought back, and when secured under the principals, will fit the more firmly.

These arch pieces are let by their lower end into the beam B, of the floor, and are thus firmly pinned, while at the top they cross one another, and each butts against its opposite principal. They are also secured by iron straps to the short pieces D D, on which the principals rest, which latter are thus prevented from sinking and thrusting out the walls, and the whole makes a stiff and compleat framing, on which the longitudinal rafters *h h*, and the transverse pieces *g g*, are fastened in the usual manner. In the middle of the building, where four principals and as many arch pieces meet, and consequently cannot

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cross each other as in fig. 1, I have inserted a kind of king-post in which the ends are secured, fig. 2.

In a common hayloft, or cottage, the same advantages may be obtained, by letting the principals rest on short pieces of wood, which may, as before described, be attached by a strap of iron to another piece going from the beams of the floor to the middle of the principal immediately under the couple beam, where it may be secured. It may be made of straight timber; but in the country, where there is always crooked timber enough about a farm, of no use for house work, this will be employed to greater advantage, as it will save what is of more value to the carpenter, and at the same time will give more space in the room.

It should be observed that roofs over barns or other buildings which have only a ground floor may be constructed in the same way, care being always taken to bring the feet of the arch-pieces so far down the wall as to give them a firm bearing.

The principals of the roof represented by one of the accompanying models are forty feet long, and those which stand angularly in the middle of the building are fifty-six feet long; and from the complete success of this experiment, I should not hesitate to apply the same principle to a roof of any given span for which timber of sufficient length could be procured.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. A. H. Holdsworth.

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N° IV.

BED-STONE OF A CORN MILL.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* T. AUSTEN, *of Waltham Abbey Mills, for his improved method of supporting and adjusting the* BED-STONE OF A CORN MILL. *The following communications have been received on the subject, and a Model of the Invention is placed in the Society's Repository.*

Waltham Abbey,
April 14th, 1819.

SIR;

I BEG leave to submit to the consideration of the Society of Arts, &c., an improvement in the mode of adjustment of the Bed-stone of a Corn Mill.

The methods hitherto adopted, are attended with much practical difficulty, and loss both of time and of produce, it being particularly requisite that all bed-stones of corn mills should be kept perfectly level and firm on their bearings, in order to obtain a good quality of flour.

To obviate this difficulty, I have adopted an improvement in a mill belonging to the Honourable Board of Ordnance, at Waltham Abbey, which is found to answer every intended purpose, uniting to simplicity of construction, accuracy of adjustment.

The model accompanying this, will show the principle of my improvement.

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The bed-stone is fixed fast in a strong cast iron frame, bedded in plaster of paris, and is of one uniform strength.

The bottom frame is of cast iron, with three screws in the bottom part placed on the plan of a triangle, for the top frame with the bed-stone to lie on; it is always firm and easily adjusted, which is not the case in the mode generally adopted wherein wedges are used.

The four screws in the sides of the bottom frame, are to adjust the bed-stone horizontally.

Trusting this will meet the approbation of the Society,

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOMAS AUSTEN.

CERTIFICATES.

Waltham Abbey,
April 14th, 1819.

WE, the undersigned do hereby certify, that the principle adopted by Mr. Thomas Austen, of Waltham Abbey, in the county of Essex, for the purpose of adjusting the bed-stone of a corn mill so that it will lie firm on its bearings, fully answers the intended purpose, upon a trial of two years at the Waltham Abbey corn mill, and is evidently a public benefit, as it produces more flour and less weight of offal from a given quantity of wheat than the mode heretofore in general use, of wedging the bed-stone up.

JOHN BY, *Major Company Royal Engineers.*
WILLIAM DRAYSON, *Clerk of the Works.*
GEORGE BARNES, *Clerk.*
JOHN KILLICK, *Hackney* } *Proprietors of Lea-bridge*
JOHN KILLICK, *Jun.* ... } *Corn mills.*

A. Aikin, Esq.
Secretary, &c. &c.

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Harlow, Essex,
Oct. 29th, 1819.

HAVING examined the cast iron curbs for the stones put into Waltham Abbey mills, by Mr. Austen, I hereby certify them to be constructed upon a principle far superior to any I have yet seen, both with respect to the facility of adjusting the bed-stone, and the equality of support which they render to the back and skirt of it in all its parts; and so far am I convinced of their utility, that I have introduced them into a new water corn mill, which I am now erecting, with four pair of stones, as they completely obviate the difficulty which, in the course of my practice, I have frequently experienced in levelling the bed-stone correctly, and at the same time to give the teeth of the stone pinion the proper hold in those of the spur wheel.

WILLIAM REDINGTON, *Millwright.*

Greenwich,
May 25th, 1819.

SIR;

I HAVE examined your method of laying and adjusting the lower or bed-stones, in corn mills, and am of opinion that it may be applied with great advantage to mills in general (particularly where the framing is weak), as the levelling may be performed in a very short time by any miller, with only the assistance of a level; and when it is considered of what importance to the miller it is, that the stones should be kept level, the advantage of the above method will be very evident.

I am, Sir,
&c. &c. &c.

To Mr. Austen. J. PENN, *Millwright.*

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Mill-place, Greenwich,
Nov. 11th, 1819.

SIR;

THE bed-stones of a corn mill at present under my direction having been out of an horizontal position, great inconvenience has been experienced, and much labour requisite to render them horizontal by means of wedges, which are often displaced and are troublesome to adjust.

Mr. Thomas Austen, of Waltham Abbey, has this day called upon me and explained his method of effecting this purpose by three adjusting screws, &c., which appears so easily and precisely to answer every purpose of obtaining a perfectly horizontal position, that I shall advise the immediate adoption of his plan.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. WILLIAM COOKE.

Reference to the Engraving of Mr. THOMAS AUSTEN'S *method of laying and adjusting the Bed-Stone of a Corn Mill,* Plate IV.

Fig. 1, a section through the mill stones and the floor; *a*, the bed-stone fixed in a cast iron case; *b b b b*, the bed of cast iron; *c c*, two of the three adjusting screws on the points of which the stone rests; *d d d d* (figs. 2, 3), four screws to adjust the stone sideways; *e e*, two beams on which the floor and cast iron bed rests, the ends *b b* being let in level with the surface; *f f*, joists; *g g*, the floor; *h h*, a raised flat circle of wood to cover the adjusting screws and bed, close to the stone; *i i*, bolts which fasten it down; *k k*, the case which incloses the stones; *l*, the hopper; *m*, the shoe; *n*, the damsel; *o*, the upper stone, which is turned by the axis *p*.

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Fig. 2, a bird's eye view of the bed-stone and cast iron bed, resting on the beams *e e*; fig. 3, the under side of the cast iron bed and stone.

Fig. 4, a perspective view of the stone in a simple iron bed adapted to lay on an old floor; it is cast without the arms *b b b b*, as shown in the other figure.

Fig. 5, a larger section of the cast iron box, in which the axis *p* turns; *q*, a metal collar which keeps the grain from the axis; the upper part *r*, of the axis *p*, is octagonal, to fit the octagonal hole of the iron box *s*, to the pin *t*, on which the upper stone *o* hangs; fig. 6 shows a side view, and fig. 7 a bird's eye view of the iron bar which is fixed in the upper stone; *v v*, cross arms which drop into the cross of the box *s*, fig. 8: these cross arms are shaped like a gothic arch, as shown in fig. 6; the box *s*, on the axis *p*, gives motion to this bar, and, by means of it, carries round the upper stone; fig. 9, a side view of the box *s*, showing the notch for the bar, fig. 6, and the bottom part of the damsel *w*, which it turns.

Fig. 1 is drawn to ½ inch to one foot; figs. 2 and 3, ¼ inch to a foot; figs. 5 to 9, 1 inch to a foot.

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N° V.

DOUBLE-DOOR SPRING.

The sum of FIVE GUINEAS *was this Session given to Mr.* JAMES WHITE, *of Laystall Street, for a* DOUBLE-DOOR SPRING. *The following communication has been received from the candidate on the subject, and one of the Instruments is placed in the Society's Repository.*

Laystall Street,
Nov. 17th, 1819.

SIR;

I BEG leave to submit to the Society of Arts, &c., the accompanying model of a Double-door Spring, which may be fixed either at the top or bottom of the door, and is so contrived that the power of the spring is the greatest when the door is shut. It is not liable to get out of repair, and the expense is moderate, not exceeding about twenty-two shillings.

I am, Sir,
&c. &c. &c.
JAMES WHITE.

A. Aikin, Esq.
Secretary, &c. &c.

On referring to the last volume (the 37th) of the transactions of the Society, page 102, will be found the description and figure of a Double-door Spring, by the same Mr. White.

The intention and general principle of each instrument are the same, but the arrangement of the parts being in

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the opinion of the Society more compact and efficacious in the present, than in the former instrument, and the object itself being of considerable importance, it has been thought advisable to lay before the public a representation of the instrument in its improved state.

Reference to the Engraving of Mr. JAMES WHITE'S *Double-Door Spring*, Plate V.

Fig. 1, the dotted lines *a a* show part of the door shut; *b*, the center on which the door turns; *c*, an arm carrying a friction roller (*d*, fig. 3); *e e*, two levers on which the spring *f f* acts, and thereby holds the door shut; *g*, a stop which prevents the levers being pushed farther than to shut the door. When the door is shut, the spring *f* acts with half its power on the arm *c*, at full length, but when the door is open as fig. 2, it acts with about one sixth of its power on the arm *c*, in a direction which reduces its effect on the door also about one-sixth, whereby the action on the door when open, is one eighteenth of the power which holds it shut; but admitting the strength of the spring to have increased by one half, there then remains a reduction of power equal to one-twelfth of the original quantity. These numbers, however, depend on the proportion of the levers, and on the part where the spring acts.

In figs. 1 and 2, the upper plate by which it is screwed to the floor is removed to show the parts; its place is shown by the dotted lines and holes *h h h h*.

Fig. 3, a section of the box; *a a*, part of the door shut; *i i*, a brass shoe screwed on the door; the center *b* is fitted into a square hole, and secured by a screw nut *k*; *l*, a screw which hooks on to the spring *f*, to regulate its power by turning the nut *m*.

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N° VI.

IMPROVED UMBRELLA JOINT.

The smaller or VULCAN SILVER MEDAL *and* FIVE GUINEAS *were this Session given to Mr.* JOHN SMITH, *Newcastle Street, Fleet Market, for an* IMPROVED UMBRELLA JOINT. *The following communication has been received from the candidate, and one of his Umbrellas is placed in the Repository of the Society.*

Newcastle Street, Fleet Market,
Dec. 21, 1819.

SIR;

I BEG to submit to the Society for the Encouragement of Arts, &c., an Umbrella Frame that possesses a new and better method of attaching the stretchers to the ribs than any now in use. By means of this improvement, the rib and stretcher are allowed to lie close to the stick when the umbrella is closed, thus taking up less room than a common umbrella of equal size; additional strength is given to the ribs, and the cover is not liable to be fretted at the junction of the rib and stretcher, an accident that perpetually occurs sooner or later with umbrellas of the common construction.

I am, Sir,

&c. &c. &c.

JOHN SMITH.

A. Aikin, Esq.
Secretary, &c. &c.

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Reference to the Engraving of Mr. SMITH'S *Umbrella Joint,* Plate V.

Fig. 4, a side view; *n n,* part of the rib, made of whale-bone; *o,* the stretcher, of brass; *p,* the connecting piece, also of brass.

Fig. 5, a front view; fig. 6, a section showing the cut which is made into the whale-bone by means of a circular cutter; *p,* a double convex piece, stamped out of plate brass, and of exactly the same curve and thickness as the cutter, so that it correctly fills the cut in the whale-bone, and is secured in its place by a rivet.

The figures are drawn of half the real size.

N° VII.

MACHINE FOR SWEEPING CHIMNIES.

The lesser or VULCAN SILVER MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* J. SKINNER, *Dean Street, Holborn, for a* MACHINE FOR SWEEPING CHIMNIES. *The following communication has been received from the candidate, and the Machine is placed in the Society's Repository.*

Dean Street, Holborn,
April 4th, 1820.

SIR;

I REQUEST that you will have the goodness to lay before the Society of Arts, &c., the head of a Chimney-Sweeping Machine of my invention. It has answered satisfactorily in the trials that I have made, or have caused to be made of it, and appears to avoid most of the imperfec-

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tions which, in the common ascending chimney-sweeping machines, are too often the occasion of much loss of time, embarrassment, and imperfect work. It is impossible to clean effectually a flue, the diameter of which is irregular and varying, unless the brushes are fixed on springs which will force the machine to occupy the entire width of the flue. In general this effect is aimed at, and is attained to a certain degree by the use of whalebone; but this substance is so much affected in its elasticity by the weather, and is so likely to be permanently warped when introduced into a chimney the soot of which is on fire, that much of the repugnance to the employment of machines instead of climbing boys, is to be attributed to this circumstance. I have therefore made the springs in my machine of steel, which, although it enhances the prime cost, will not be found in the end to be more expensive, and at the same time they are both more powerful and certain in their operation. The construction of the machine allows it to pass through a flue nine inches in diameter, and enables it also to fill a flue twenty inches in diameter. In the latter situation there are vacant spaces about the center of the machine which allow the soot to fall in proportion as it is detached from the sides by the action of the brushes; hence its ascent up foul chimnies is greatly facilitated. The machine itself accompanies this letter, and I shall be happy to attend the Committee when required, for the purpose of giving any farther explanation.

The cost of the machine, exclusive of rods, is from thirty to forty shillings.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JAMES SKINNER.

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Reference to the Engraving of Mr. JAMES SKINNER'S *Machine for Sweeping Chimnies,* Plate VI.

Fig. 1, the machine expanded, composed of eight square brushes mounted on steel springs; the four upper springs are screwed fast at *a, b, c,* and *d,* to the sloping ends of the wooden cross piece *d,* and the four lower springs are screwed in the same way to the bottom at *e, f, g,* and *h,* so as to alternate with the upper ones; and when pressed close by the sides of the chimney, they lie together, as fig. 2; *i, k, l, m,* and *n, o, p, q,* are eight guide springs (or straps), made of iron, by which the brushes can be closed in moving either way without catching against protuberances; these guide springs have holes in their bent ends, by which they slide on the guide wires, *r r r r,* and *s s s s;* *t* and *v* are two cross pieces to support the guide wires; one is shown separate at fig. 3; the bent ends of the guide wires are inserted in the eyes *u u u u;* fig. 4 shows one of the guide springs *o* and wire *s,* separate; *w,* a rolling ball to lessen friction; *x,* the joint at which it is connected to the other sticks; wire staples are fixed in the end of each brush, shown at *z z z,* fig. 2, to form the joint with the folded end of the guide springs, shown at *y,* fig. 4.

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N° VIII.

SPRING BANDAGE.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* J. GORMAN, *Fellow of the Royal College of Surgeons, for a* SPRING BANDAGE OR TRUSS, *in order to support and compress the abdominal viscera. The following communication has been received from the candidate, and one of his Machines has been placed in the Society's Repository.*

Spanish Place, Manchester Square,
January 7th, 1820.

SIR;

I BEG leave through you to submit to the Society of Arts, a machine which I have invented, for the support of spinal and abdominal weakness.

This band, or machine, consists of five pieces of elastic steel, two for the abdomen, one for the spine, and two surrounding springs; the two surrounding springs are joined to the center of the spinal plate by means of screws, and in like manner to the abdominal plates, and these two unite by means of straps and buckles.

This band can be made to suit all ages, sizes and shapes; and is applicable to all cases of spinal weakness, where the bones are not absolutely carious.

To those persons who are inclined to corpulency, this band will perhaps be most useful; there is no pressure on the hips, loins, nor ribs, while from its peculiar

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mechanism, it is calculated to reduce the most corpulent habits. Its application can never be attended with bad effects, like the belts that are generally worn, which divide as it were the viscera into two portions, and by producing general pressure, almost always impede the secretion of the kidneys.

This band, on the contrary, accommodates itself to the exact form of the body (which form is not altogether circular), throwing the pressure on the spine and abdomen, leaving the loins and kidneys perfectly free, and by gently pressing the viscera inwards and upwards, greatly diminishes the risk of hernia or rupture.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. J. GORMAN, *Member of the Royal College of Surgeons, in London, &c. &c.*

Explanation of the Engraving of Mr. GORMAN'S *Bandage,* Plate VI.

Fig. 7 represents the steel springs and plates of which Mr. Gorman's bandage is composed, and which, when in use, are covered and properly padded to prevent any painful pressure or excoriation. The square plate is that which is applied to the spine; the two semi-circular ones are those which support the abdomen; these latter are drawn as near to each other as the ease of the patient will admit, by means of strings fixed to the cover, which may be made of calico or any other suitable material.

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N° IX.

IMPROVED CONSTRUCTION OF ANVILS.

The smaller, or VULCAN SILVER MEDAL *and* FIVE GUINEAS *were this Session voted to Mr.* RICHARD KING, *of Thames Street, Bankside, for his improvement in the* CONSTRUCTION OF ANVILS. *The following communication has been received from the Candidate, and Models of the Invention have been placed in the Repository of the Society.*

8, Thames Street, Bankside,
22nd March, 1820.

SIR;

HAVING long experienced the difficulty attending the making of sound Anvils (used by smiths in all departments of the trade) by the present system, and the frequency with which the quarters and beak irons break off, I am induced to request that you will please to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce, the model of an improvement suggested by me, in the manufacture of that article, which will obviate the frequent occurrence of breaking in those manufactured in the common way; and of which I also send a model, to show more clearly the nature of my improvement.

If the Society should be pleased to consider it worthy their countenance and support, I shall feel myself ho-

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noured, and will attend to explain whenever they may be pleased to take it into consideration.

I am, Sir,
&c. &c. &c.
RICHARD KING.

A. Aikin, Esq.,
Secretary, &c. &c.

The usual way of making large anvils is, first to forge a nearly cubic mass for the body of the anvil, and then to unite the beak and quarter with this block, by means of plain *vertical* surfaces, secured by welding. The feet are also welded on in the same manner. The face is made of steel, and is laid on the top of the body of the anvil and of the quarter. The several parts above mentioned are shown in Plate VI, fig. 5. It is obviously, however, impossible, on this construction, that the welding should be effectual for more than an inch or two from the external line of junction: hence a succession of heavy blows on the face of the anvil will necessarily sooner or later cause these vertical joints (especially of the beak and quarter) to give way.

Mr. King follows a very different process. He forges the body as well as the beak and quarter of one piece of iron, and the foot or support of another; these are united by means of a *horizontal* plane, joint and welding, as shown fig. 6, from which it is manifest that the usual causes of the destruction of anvils are avoided, with the farther advantage of increased simplicity in the manufacture.

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Nos X AND XI.

WARMING AND VENTILATING ROOMS, AND VENTILATING THE HOLDS OF SHIPS.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* JACOB PERKINS, *of London, for his* METHODS OF WARMING AND VENTILATING ROOMS, AND OF VENTILATING THE HOLDS OF SHIPS. *The following communications have been received from the Candidate on the subject.*

Austin Friars,
March 28, 1820.

SIR;

I REQUEST that you will have the goodness to lay before the Society of Arts, &c., the accompanying papers and drawings, descriptive of a method which has been practised by me with perfect success, of ventilating and warming apartments and workshops; and also a method of ventilating the holds of ships.

I am, Sir,
&c. &c. &c.
JACOB PERKINS.

A. Aikin, Esq.,
Secretary, &c. &c.

A method of Warming and Ventilating Apartments and Warehouses.

THIS improvement consists simply in introducing a large column of cold air immediately at the back of

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large column of cold air immediately at the back of the stove, by which means the radiant heat from the stove is rapidly carried off. The greater the quantity of air which is made to strike against, and pass by the stove, the greater is the quantity of heat given out by it. This kind of stove will not work to good advantage when the room is air-tight: to remedy this evil, an aperture should be made near the ceiling. But where there is a chimney draft in the room, opposite the stove, or in the next or third room from the stove, the effect is very much increased, especially if a small fire is kept up in the chimney of that room. This constant current of warm air ventilates the rooms perfectly, and renders them pleasant and wholesome. It has also been found, that the air is very much improved by having a vessel of water placed on the top of the stove, so that evaporation may be constantly going on.

Reference to the Engraving of Mr. PERKINS' *Apparatus,* Plate VII.

Fig. 1, front view of the stove.

Fig. 2, side view of ditto.

Fig. 3, plan of ditto.

a a a, the body of the stove.

b b b, a sheet of iron affixed to the air conductor, and embracing $\frac{2}{3}$ the diameter of the stove, and extending from top to bottom, leaving a space of two inches between it and the stove.

c c c, the air conductor, being about the same diameter as the stove. It is also attached to the sheet of iron *b.*

d, the wall into which the air conductor is fixed.

e e e, a cup to be supplied with water from time to time, as the former portion evaporates.

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A method of Ventilating the Holds of Ships.

Plate VIII, fig. 1, a plan of part of a ship, showing a ventilator placed diagonally across it.

Fig. 2, section of a ventilator.

a a, tanks, or water butts.

b b, hose for conducting the foul air *into* the tanks.

c c, hose for conducting the foul air *from* the tanks.

d, connecting water pipe.

e e, valves for admitting the foul air into the tanks.

f f, valves for allowing the foul air to escape.

The operation of this self-acting ventilator is as follows: Each tank or butt is half filled with water, which flows freely from one to the other through the pipe *d*. The quantity of water running alternately from each depends upon the motion of the ship. When one of the tanks is elevated by the ship's motion, the water will run through the pipe *d* into the depressed tank, and thereby discharge as much foul air through the valve *f* as the additional water displaces. The elevated tank at the same time is receiving the foul air through valve *e*, from the hold of the ship, to supply the vacuum that would otherwise be made by the escape of the water. If the tanks are fixed at right angles with the keel of the ship, the ventilator will operate only with the roll of it; but, if placed diagonally, both the pitch and roll of the vessel will discharge the foul air. It would be most economical to fill the tanks at the beginning of the voyage. The first water for the ship's use should be taken from the ventilating tanks, leaving, however, half of it behind for operation. If the remaining water should ever be wanted for the ship's use, it can be drawn off, and replaced by salt water. It will be seen that, by this mode of ventilating, nothing but the hose and valves are to be added to what must necessarily be on board every ship.

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N° XII.

IMPROVED CONSTRUCTION OF THE RIBS OF GROINED ARCHES.

The smaller, or VULCAN GOLD MEDAL *was this Session voted to Mr.* JOSEPH JOPLING, *of Somerset Street, Portman Square, for his* IMPROVED CONSTRUCTION OF THE RIBS OF GROINED ARCHES. *The following communication has been received from him on the subject, and Models of his Invention have been placed in the Society's Repository.*

24, Somerset Street,
Portman Square.

SIR;

I TAKE the liberty of troubling you with the accompanying papers and models illustrating a new method of constructing Ribbed Groins, which you will do me the favour to lay before the Society. When the Committee may be pleased to examine them, it will give me pleasure to attend, and to furnish any explanation that may be required.

I am, Sir,
&c. &c. &c.
JOSEPH JOPLING.

A. Aikin, Esq.
Secretary, &c. &c.

HAVING observed that much difficulty is experienced in executing ribbed groins in plaster, and that the work

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is done in a very incorrect manner; and having heard that others have made the same observation, I am induced to offer to the Society of Arts, Manufactures, and Commerce, a few observations, drawings, and models, which, I conceive, may be the means of reducing the expense and improving the appearance of works of this nature.

The desirable object is, to form the surfaces of groins, so that the curvatures of the various ribs may be without cripples, that they may intersect truly, and stand perpendicularly over their respective plans, and that they may be executed by the usual mode of running plaster mouldings.

In the early examples of ribbed groins, few, if any of the ribs, intersect truly at their springing. Whether this occurred through design, or from not knowing the principles of intersection, may be doubtful. If it was intended to imitate the spreading branches of trees, perhaps it was thought more natural for some of the ribs to rise behind others, than that they should intersect truly; yet, as we see other intersections hidden with foliage, it would appear that their not intersecting truly was considered a defect; for instances occur where the intersections being correct, there is no foliage; and in the same groin, where the intersections are not true, foliage is added. Those persons who introduced ribbed groins of the same curvature, it is probable, had discovered that ribs must be of like curvature to intersect truly at their springing; and that ribs of merely like sections would not do so. It is likely that their object, in introducing them, was to have the intersections true. They might also wish to save the trouble of determining the forms of separate ribs, by the slow geometrical process of ordinates. However, the time required to determine the forms of the ribs is not an object, when compared with the time required to execute them.

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References to the Figures of Mr. JOPLING'S *method of constructing Groined Arches,* Plates IX and X.

Fig. 1 is the plan of a square groin. At A the corresponding numbers represent the old method of corresponding points of height in the different ribs. At B the corresponding numbers represent the corresponding points of height, by the proposed plan.

Fig. 2, represents the curvatures of the three ribs *a*, *b*, and *c*, according to the old method at A, fig. 1.

Fig. 3, represents the curvatures of the ribs *a*, *b*, and *c*, according to the proposed method at B, fig. 1.

Fig. 4, plan of intersections of ribs, calculated for the old method; this application is shown at C, fig. 1.

Fig. 5, section of *a*, or given rib, fig. 4: the section of rib *e*, fig. 4, is the same.

Fig. 6, section of rib *b*, fig. 4, at the bottom, or springing. This rib must vary from the form of fig. 6 to the form of fig. 5.

The rib *d* will be its reverse. These cannot be executed by a running mould.

Fig. 7, section of rib *c*, fig. 4, at the bottom, or springing. This rib must vary from the form of fig. 7, to the form of fig. 5. This cannot be executed by a running mould.

Fig. 8, plan of intersections of ribs, calculated for the proposed method. Their application is shown at D, fig. 1. By the usual method of running plaster mouldings, the whole of the ribs *a*, *b*, *c*, *d*, and *e*, may be executed.

Fig. 9, plan of intersections meeting in a common point, and showing the two methods, when the ribs are more crowded in one place than another; the application of the old method is shown at A, fig. 15; and the application of the new method at B, fig. 15. The new method may be executed with one mould.

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Fig. 10, section of rib *b*, fig. 9, at the bottom, or springing, as required by the old method.

Fig. 11, section of rib *c*, fig. 9, at the bottom, or springing, as required by the old method.

Fig. 12, section of rib *d*, fig. 9, at the bottom, or springing, as required by the old method.

Each of these last ribs must vary from their respective forms to that of the rib *a*, fig. 5, or they will not intersect with the ribs *a* or *e*, or with each other.

None of the ribs *b*, *c*, or *d*, as applied at A, fig. 15, can be executed by the usual mode of running plaster mouldings.

Fig. 13 shows how ribs making the same angles with each other, as in fig. 9, may stand at their springing, so as not to be more crowded in one place than another; their application is shown at C, fig. 15; these may be executed with one mould.

Fig. 14 shows how ribs making the same angles with each other, as in the last, and fig. 9, may stand, so that the height of all the intersections may be alike; these may be executed with one mould; their application is shown at D, fig. 15.

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N° XIII.

IMPROVED BLOWING MACHINE.

The large SILVER MEDAL *and* FIFTY GUINEAS *were this Session voted to Messrs.* JEFFRIES *and* HALLEY, *Great Guilford Street, Southwark, for an* IMPROVED BLOWING MACHINE. *The following communications have been received on the subject, and a Working Model of the Machine is placed in the Society's Repository.*

Great Guildford Street, Southwark,
April 28, 1819.

SIR;

HAVING invented a very commodious method of applying large bellows for smiths' and founders' use, which many of our friends flatter us as being likely to be highly beneficial in those and other branches of Mechanics requiring strong blasts, we beg leave to submit the same, with the accompanying certificates, to the consideration of the Society of Arts, &c. &c., being well assured that if the invention possesses any merit, it will meet the Society's liberal patronage.

We are, Sir,
&c. &c. &c.

J. JEFFRIES.
WM. HALLEY.

A. Aikin, Esq.
Secretary, &c. &c.

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CERTIFICATES.

Deptford Dock Yard,
December 8, 1819.

SIR;

THESE are to certify whom it may concern that the Honourable Navy Board ordered a Blowing Machine of Messrs. Halley and Jeffries to be made trial of, to see if they would answer the purpose of making large anchors in Deptford Dock Yard. We have made trial, and find them to answer our full expectation.

C. FLEMING, *Master.*

Deptford Yard,
February 4, 1820.

HONOURABLE SIRS;

IN obedience to the directions in your Honourable Board's letter of the the 21st ult., we beg to send you, as follows, answers to the several questions in regard to the Blowing Apparatus invented by Messrs. Halley and Jeffries now under trial at this yard:

1*st.*—The effect produced as compared with the ordinary bellows; and whether it requires more time to prepare a heat with this apparatus than it does with bellows of the ordinary description, supposing the anchors to be of the same weight?

Answer.—The effect is much greater than the ordinary bellows, and, consequently, will prepare the heat in less time, the weight of the anchors being equal.

2*nd.*—The space occupied by it compared with that occupied by the ordinary bellows?

Answer.—The space occupied is not more than one half of that occupied by the ordinary bellows, and might be placed, if necessary, in an elevated situation, entirely out of the footway.

3*rd.*—The cost of the apparatus compared with the cost of the ordinary bellows?

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Answer.—The Blowing Machine of Messrs. Halley and Jeffries, as fitted, 52*l.* 10*s.*: walking bellows, of 11 feet (the size superseded by those of Messrs. Halley and Jeffries) being 52*l.* without fitting.

4th.—Whether the apparatus, as far as you are enabled to form an opinion is superior or inferior to the blowing apparatus invented by Mr. Street, and in what particulars; and whether in your opinion, this apparatus could be generally or only partially adopted?

Answer.—The master smith is of opinion that the apparatus of Messrs. Halley and Jeffries is superior to that invented by Mr. Street: in the first place, it does not occupy half the space, blows a stronger blast, is not so soon out of order, will last a greater length of time, and requires less labour to work it; and further, that this apparatus appears to be fit for fires where two or more men are employed, but not for single-handed fires.

We remain, &c.

(Signed) WM. STONE.
JAS. HILLMAN.
F. J. HAWKES.

(Attested copy) R. NELSON.

Deptford Dock Yard,
March 23, 1820.

GENTLEMEN;

IN reply to your application to me for a declaration of my approbation of your invention of the Blowing Machine now in his Majesty's smithery at Deptford, I can have no hesitation to state, that from its performance, before I had inspected its interior, I was impressed with a very favourable opinion of its superiority over all mechanical blasts I had witnessed; and having seen the interior of the model you submitted to my inspection, am of opinion that

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its mechanism is simple, likely to be durable, and has confirmed my previous good opinion.

W. STONE, *Master Shipwright.*

Messrs. Jeffries and Halley.

10, Long Acre,
December 9, 1819.

SIR;

IN answer to your request as to my opinion of the bellows you made for Fraser and Chater, I can say that I recommend them with the most perfect confidence; they revolve in little compass, and have a power much beyond their bulk; in fact the invention seems to me of general advantage, as the machines in use at present require much more labour than your's. I have to regret, on your account, that you have no patent, being convinced that the strength, simplicity, and power of your machine must bring it into great request.

I am, Sir,
&c. &c. &c.

Mr. John Jeffries. JAMES FRASER.

Foundry, Upper Ground Street, Christ Church, Surrey,
December 9, 1819.

WE hereby certify, that, having for the last nine months had a pair of Jeffries' and and Halley's Blowing Machines in constant use, we are perfectly satisfied of their superiority over every other description of blast we have hitherto seen used, and the men working them seem perfectly satisfied they save much labour.

WARD & AINGER.

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Iron Works, Wandsworth,
March 22, 1820.

UPON a trial this day made of a Blowing Machine by Jeffries and Halley, it was found to have melted a charge of eighteen hundred weight in one hour and ten minutes.

GEORGE DAY & SON.

Reference to the Figures of Messrs. JEFFRIES' *and* HALLEY'S *Blowing Machine,* Plates XI and XII.

Fig. 1 is an outline plan of the machine, showing the end opposite to that exhibited fig. 3.

Fig. 2 is an outline plan of the machine in the same

Fig. 3 is a view, and fig. 4 a section of the machine, the one at right angles to the other.

position as the section, fig. 4.

The same letters refer to the same parts in all the figures.

a, a cranked handle, worked by two or more men, according to the size of the machine.

b, a fly wheel, fixed on the end of the axis opposite to that where *a* is placed, for the purpose of equalizing the motion.

c, fig. 4, a crank fixed on the middle of the axis, and working in an air-tight semicircular box. By means of this crank the revolving motion impressed at the handle is converted to a reciprocating one, for the purpose of alternately opening and shutting the vertical bellows *d*. These bellows, from their vertical position, require only a small degree of power to keep them in action: they draw in the external air by the valves *k k*, fig. 1, and discharge it through the valve *h*, fig. 4, into the nozzle *e*.

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The box, or outer case, in which the vertical bellows are inclosed being air-tight, it necessarily follows, that when, by the action of the crank *c*, the bellows are compressed, a partial vacuum will be formed in the box. In order to restore the equilibrium, a portion of external air will rush in through the valves *i i*, which portion will, by the next succeeding expansion of the bellows, be driven through the valve *g* into the head or regulator *f*, which it inflates and raises, and the top of which may be loaded with weights, in order to give any required degree of compression to the inclosed air. This air is expelled from the regulator through a valve opening downwards into the trunk, of which the nozzle *e* is the exit. The whole of the machine is of iron, except the leathers of the bellows and of the regulator.

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N° XIV.

IMPROVED BLOCKS AND SPRINGS FOR WHEEL-CARRIAGES.

The large SILVER MEDAL *was this Session voted to Mr.* FRED. C. CHERRY, *Veterinary Surgeon, Clapham, for his* IMPROVED BLOCKS AND SPRINGS FOR WHEEL-CARRIAGES. *The following communications have been received from the candidate on the subject, and Models of his Inventions have been placed in the Society's Repository.*

Croydon,
May 3rd, 1819.

SIR;

I INCLOSE a paper on the application of Springs to Wheel-Carriages, and request you will do me the favour of laying it before the Society for the Encouragement of Arts, Manufactures and Commerce.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. FRED. C. CHERRY.

Croydon,
April 1819.

HAVING for many years had repeated opportunities of witnessing the imperfections of the various carriages employed for the purposes of military transport, my attention has been directed to the invention of a carriage for general

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military purposes, more efficient and more simple than any heretofore in use.

In the course of pursuing this subject, I have employed a simple contrivance, which may be easily applied, at a small expense, to a variety of carriages, employed for a variety of purposes, in civil or domestic life; and it consists of a mode of entirely protecting from injury the ordinary springs of a cart or other carriage, when heavy loads are to be carried; while it admits of their free use when light loads are carried.

Springs to carriages are usually applied of a strength proportioned to the probable average weight of the loads to be carried; so that when the load is much less than the average, the springs will not yield, or at best do so but imperfectly; while on the other hand, a load much heavier than the average overcomes their elasticity and entirely destroys their effect. From excessive pressure springs often get bent, and otherwise permanently injured.

As an attempt at obviating this inconvenience, fixed blocks of wood are very commonly used, so placed as to limit the action of the springs. The evil of this confined action is felt, when light loads are carried, by frequent shocks, by a jolt or thump every time these blocks produce their effect; and when heavy loads are carried, the springs are strained and injured by being kept constantly bent to a degree to overcome the whole of their elastic power that can ever be brought into action.

In searching for information on this subject, I certainly have been told that a block moveable on a centre, has by other persons been employed with the same intention; but still it appears to me, that even this mode, which, however, differs materially from that I am about to describe, cannot have been applied with simplicity and good effect, as in that case we should find moveable blocks in common use.

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My contrivance readily admits of full scope for the springs when light loads are upon them; while with equal facility it may be made to remove all strain whatever from the springs, when heavy loads are placed on the carriage.

This change is brought about by the simple action of a horizontal lever pushed from one corner or side of the carriage to the opposite corner or side.

The contrivance to admit of this change consists of two blocks of wood made to slide on the upper surface of the axletree bed; and the means of connecting these sliding blocks with the arm or lever by which they are put in motion.

The sliding blocks are kept on the axletree by thin plates of iron fixed at the side of it; the fulcrum of the lever is a pin fixed in the centre of the axletree; a small iron rod, moveably attached at each end, connects the lever and the blocks respectively; so that pressing the lever in one direction separates the blocks to a greater distance from each other, by which means they are interposed between the axletree and the side pieces of the cart or other carriage, and support it independent of the springs; while, passing the lever in an opposite direction causes the blocks to approximate, withdraws them within the side pieces, and, independent of the resistance opposed by the springs, allows a free descent to the whole body of the carriage, until the side pieces reach the upper surface of the axletree.

When the load is a heavy one, the blocks, by means of the lever, are pushed under the side pieces of the cart or other carriage to bear its entire weight, and are kept in that situation by fixing the end of the lever. When the load is not greater than the springs can properly sustain, the cart or other carriage is allowed to rest on them, by passing the lever to the opposite side, when the blocks are withdrawn from under the side pieces, and are received

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into the space produced by the difference in thickness between the boarding of the bottom and the side pieces. By increasing the thickness of the side pieces edgeways, the blocks may also be increased in thickness, and scope for action for the springs obtained to any extent.

It must be obvious that the mode of construction here described will admit of variation, and that there are other ways of bringing about the same end.

The simple contrivance already described, appears to be tolerably perfect as far as it goes, but it leaves the class of heavy loads without the advantages resulting from springs; advantages which it is not necessary for me to make any observations on in this place. I therefore continued my attention to this subject with a view so to apply springs as to adapt them to two averages of loads instead of one; to give the advantages of efficient springs to heavy loads as well as to light loads carried on the same carriage; and this end also appears to be attained to a tolerable degree of perfection.

Now in the course of my inquiries, I have also been since told that springs have been employed by other persons with the same intention; but still, as with regard to the use of blocks, I am induced to believe that the mode of employing them has been imperfect, or from the great benefit to be derived at a small expense, moveable springs would be found in use very generally.

For the purpose already stated, I have employed, instead of the sliding blocks, a stout spring, either straight or curved as may be requisite: this is moveable on a centrical pin similar to the fulcrum of the lever used to give motion to the sliding blocks. To this spring is attached a lever sufficiently oblique to allow its end to rest opposite a convenient place, one hind corner for instance, while the spring lying straight with the axletree has each end respectively under the side pieces of the cart or other

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carriage, and contributes to support its weight; which in this case is borne partly by the ordinary longitudinal springs, and partly by the additional transverse one, each being acted on at the same time in a similar degree. The lever being passed to the opposite side or corner, turns or twists the spring in a direction oblique to the axletree, and partly across it; by which means it remains at rest in the hollow space under the boarded part of the bottom of the cart or other carriage, leaving the slighter longitudinal springs full scope for their action. An iron slide fixed to each side piece receives the first pressure from the spring and guides it into its place.

The mode already described applies to the spring being moveable on the centre of the axletree; it may, however, be made moveable on the centre of the bottom of the cart, and the iron slides of direction be placed on the axletree.

Practice will doubtless suggest various other modes of application; but the basis of my ideas on this subject appears to be sufficiently developed in this letter to answer the purpose of bringing the subject into further notice. My own attention will of course be continued, and as soon as some models now in hand are completed, I shall place them at the disposal of the Society.

Rathbone Place,
March 27th, 1820.

SIR;

I HEREWITH send a description to be annexed to the drawings made from the models furnished by me, and tending to elucidate the principle of applying moveable blocks, and an equalizing moveable spring, to carts and other carriages.

Although I have stated in the paper transmitted to the Society in May last, that my attention had been directed

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to the invention of a carriage for general military purposes, it was only to show how this subject had first engaged my consideration. The military improvement I have brought under the notice of the proper military authorities, and it is that part alone which appears to me to be equally "applicable to a variety of carriages, employed for a variety of purposes in civil or domestic life," that I have here attempted to explain.

In the paper already mentioned, I describe the moveable spring as attached to the axletree, but state that it may be made moveable on the bottom of the cart: in the model it is so placed, and the drawings also represent it in that situation, which, perhaps, may be considered the best, as not exposing it when inactive to all the concussion the axletree receives. The moveable blocks may also be attached to the bottom of the carriage. The principle of moveable blocks, and equalizing moveable springs, is susceptible of numerous modifications, and either one or the other may be very generally applied to a great variety of carriages, employed to carry at different times loads of very unequal weight, without altering the present mode of construction, and consequently at a small expense.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. FRED. C. CHERRY.

Reference to the Engraving of Mr. CHERRY'S *moveable Blocks and equalizing moveable Spring, for Carts and other Carriages,* Plate XIII.

Fig. 1 represents a plan of the axletree and springs of a cart (the body being removed), and shows the moveable blocks as interposed to prevent the springs being acted on by heavy loads.

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a a, the axletree; *b b*, the springs; *c c*, transverse rails uniting the side pieces of the cart; *e*, a lever, jointed at *g*, to give motion to the sliding blocks *q q*, the lever and blocks being connected by the plates *r r*; *l*, a leathern strap for loosely fixing the end of the lever at *m* or *m*.

Fig. 2 represents an elevation of the axletree, springs, and moveable blocks, together with a section of the side pieces and bottom of the cart; the blocks being applied to support the weight of a heavy load.

a a, the axletree; *b b*, the springs; *q q*, the moveable blocks; the lever and connecting plates being removed, *v* indicates its fulcrum; *s s*, plates to retain the sliding blocks on the surface of the axletree: pins fixed in the blocks *q q*, transverse in the plates *s s*, and prevent the blocks rising; *n*, the floor of the cart.

Fig. 3 is similar to fig. 1, but the lever *e* being passed to the opposite side, the blocks *q q* are made to approximate, by which they cease to act, and the springs then sustain the cart in the usual manner.

Fig. 4 is similar to fig. 2, but the blocks having been made to approximate, the cart is allowed to rest on the springs, and by their yielding to descend through the space *u u*.

Fig. 5 is a side view of the lever, and shows the moveable joint *g*.

Fig. 6 shows more clearly the use of the joint *g*, in the lever *e*; when the springs *b b* are acted on, the cart *n* descends, and with it the oblique part of the lever *e*, but the joint allows the horizontal part *f*, to retain that situation. As the oblique part of the lever *e*, approaches to the situation of a right line with the horizontal part *f*, it elongates backwards, and occasions a necessity of employing some kind of attachment for the end of the lever that will admit of this motion: a strap and buckle answers

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the purpose very well: *a*, the axletree; *o*, the shaft; *q*, the moveable block.

These six figures are intended to explain the mode of applying and using the moveable blocks: it must be obvious that when the lever is passed to the right, the blocks will be separated to a distance from each other and interposed between the springs and the side pieces of the cart, so as to support it, and completely prevent any descent. It must be equally obvious, that when the lever is passed to the left, the blocks will be made to approximate; that they will be withdrawn from under the side pieces of the cart; that the cart may then descend as the springs yield, since the difference between the thickness of the side piece and the thin-boarded bottom, gives space for this action to take place, as particularly shown in fig. 4.

Of course but one mode is here described of applying this invention; but by employing a little ingenuity, it will be found that the principle may be applied to almost every cart in common use.

Fig. 7 represents an axletree *a a*, with the ordinary side springs *b b*, and an additional moveable spring *d*, which may have any convenient degree of curvature, resting by its extremities on the axletree; it is attached to the bottom of the cart by a bolt at *v*, acting as a fulcrum; *e* is a lever fixed by a strap *l*, or otherways to the hind part of the cart at *m*, to keep it in that situation; *i i* are iron slides of direction to receive the first pressure from the ends of the spring, and guide it to the situation here represented. The cart being loaded, this spring acts in conjunction with the other two, and the whole yield in an equal degree; *c c*, transverse rails uniting the side pieces of the cart.

Fig. 8 is similar to fig 7; but the lever *e* being passed to the opposite side of the cart, and fixed at *m*, the moveable spring *d* is placed obliquely across the axletree *a a*, and

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remains at rest, the cart being in this case entirely supported by the side springs *b b*.

Fig. 9 represents an elevation of fig. 7; *a a*, the axletree; *b b*, the side springs; *d*, the moveable spring; *e*, the lever acting on the moveable spring; *h** a transverse bar of wood or iron fixed at the bottom of the cart, and to which is attached the moveable spring; *n*, the bottom of the cart; *k k*, leather straps to restrain either side of the cart from rising when the other is depressed.

The lever *e* being passed to the opposite side, places the moveable spring *d* obliquely across the axletree, as shown in fig. 8, by which it remains inactive, while the body of the cart resting on the side spring, descends through a space given by the curvature of the spring *d*, equal to *f*, which space may be increased in various ways.

The principle of a moveable spring is susceptible of a very great variety of modifications.

Fig. 10 is a side view of fig. 8, and shows the slope of the iron slides of direction *i i*, and the position of the moveable spring *d*, when at rest.

Clapham,
October 30th, 1820.

SIR;

SINCE my last communication on the subject of moveable blocks, and equalizing moveable springs for carts and other carriages, I have applied moveable springs to two carriages belonging to the private establishment of his Majesty: in the first instance to a luggage cart, employed to carry at different times loads of very unequal weight, and perhaps the best certificate of its utility is the fact of my being afterwards directed to apply additional springs on my principle, also, to a four-wheel carriage, the effect in both cases obtaining full and complete approbation.

* In the engraving, *b* has, by mistake, been substituted for *h*.

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The weight of every article used in applying the spring to the cart being 12 lbs., and the two springs to the four-wheel carriage 18 lbs., exclusive of the weight of the springs themselves, which are of an ordinary make.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. FRED. C. CHERRY.

P. S. I shall be happy to remove any difficulties that may occur in the practical application of the invention here described, on application being made to me at my house at Clapham.

N° XV.

HOSE FOR FIRE ENGINES.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* JACOB PERKINS, *of London, for his* METHOD OF FASTENING THE SEAMS OF HOSE FOR FIRE ENGINES, AND OF CONNECTING TWO OR MORE LENGTHS OF HOSE TOGETHER. *The following communication has been received from the candidate on the subject, and a specimen of the Hose has been placed in the Repository of the Society.*

No. 29, Austin Friars,
Dec. 22nd, 1819.

SIR;

HAVING made some improvements in the Leather Hose for Fire Engines, which I have found to answer well in America, I am desirous of submitting them to the notice of the Society for the Encouragement of Arts, Manufactures, and Commerce; and will attend to explain

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them before the Committee to whom the Society may refer them, upon being informed when they will be taken into consideration.

I am, Sir,
&c. &c. &c.
JACOB PERKINS.

A. Aikin, Esq.,
Secretary, &c. &c.

Reference to the Engraving of Mr. PERKINS' *Improved Hose for Fire Engines,* Plate XVI.

Fig. 1, a view of two pieces of double-rivetted hose, united by swivel joints.

Fig. 2, section of the above, showing that at the swivel joints, the water way is not contracted.

A, B, the swivel joint and female connecting screw.

C, male connecting screw.

a a, swivel joint ring.

b b, groove for swivel joint ring.

Fig. 3, section of parts of the connecting screws, on an enlarged scale.

Fig. 4, end view of the rivetted hose.

Figs. 5 and 6, end and side sections of the hose, as fastened to the connecting screws.

Fig. 7, view of the method of joining the hose.

Fig. 8, end section of the hose.

Fig. 9, side section of it.

The improvement in this hose is in rivetting, instead of sewing it; and in connecting the hose with a new modification of the swivel joints, in such a manner as not to contract the water way at the joints. The first idea of rivetting hose, belongs to Messrs. Pinnock and Sellers, of Philadelphia, and has been in successful practice 12 or 13 years, but without the leathers being overlapped sufficiently. The method of connecting the hose belongs to

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Mr. Perkins. The advantage of rivetting over sewing, is, that the seam lasts much longer, and is much tighter. The rivets, which should be made of copper, will last 4 or 5 times longer than the best thread. If care is taken to have sufficient overlap (see fig. 8), the pressure of water against the overlap, acts as a valve to tighten the seam. It has been found by experience, that the portion of hose next the engine, is much the most likely to burst, especially when the water is carried perpendicularly; to obviate this difficulty, the 1st, 3rd, or 4th portions (see fig. 1) are double-rivetted.

The method of connecting the different portions of hose is as follows: figs. 2 and 3 show sections of the male and female connecting screw and swivel joint; A forms the female part of the swivel joint, which is attached to the hose, by being screwed within the female screw *c c*; it is prevented from collapsing, by the brass ring *d* within it. On the outer side of this female screw is a groove *b b*, in which revolves the swivel ring *a a*; this swivel ring is fixed to the female connecting screw B, by means of rivetting over the end of it at *f*. The male screw C, is attached to another portion of hose, in the manner before described.

Fig. 4, end view of the hose as rivetted, showing also the overlap.

Fig. 5, section of that part where the hose is fixed to the connecting screws. The brass ring *d*, expands the hose, *g*, sufficiently to allow a screw to be cut on the leather embracing the ring *d*, by the female screw B.

Fig. 6 shows the manner of holding the hose while in the act of screwing it into the connecting screw (see A and C, in fig. 2). D, a block or cylinder of wood just large enough to pass through the ring *d*; this block prevents the hose from collapsing while it is held (in a vice,

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or otherwise), for the purpose of resisting the action of forcing on the screw *c c*.

Fig. 7 shows the means of connecting the different pieces of leather that compose the hose, which is effected by a spiral joining of double rivets.

Fig. 8, end section (full size) of the hose, showing the overlap or valve.

Fig. 9, side section (full size) of the rivet seam.

When a rivet breaks, it is replaced by making an opening in the seam, of sufficient size to allow the hand to replace not only the broken rivet, but the rivets taken out to enlarge the opening. After the rivets are fixed in the holes, they are rivetted by placing them on a flat bar of iron, introduced in the entrance of the hose, and capable of being removed at pleasure. Copper has been found to answer best. It is of such importance that the rivet and burr should be of the same material, that it would not answer well to have the rivets of *cast* copper (they being an alloy of tin and copper), and the burr of *wrought* copper. Tin rivets, with copper burrs, will completely destroy the leather in a few months, occasioned undoubtedly by the operation of galvanism.

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N° XVI.

IMPROVED SHIPS' PUMP.

The large GOLD MEDAL *of the Society was this Session presented to Mr.* JACOB PERKINS, *of London, for his* IMPROVED SHIPS' PUMP. *The following communication has been received from the candidate on the subject, and a Model of the Pump has been placed in the Repository of the Society.*

29, Austin Friars,
January 10, 1820.

SIR;

I BEG to submit, for the approbation of the Society for the Encouragement of Arts, Manufactures, and Commerce (of which I have the honour to be a member), a model of a Ship's Pump, which has the advantage of being capable of being constructed of materials always to be found on board, and by any ship's carpenter, without the necessity of boring the barrel, as in the usual pumps; the construction of the valves in the piston and foot valve will also be found exceedingly easy, and to afford a large water-way; and, although the principles on which they are constructed is a modification of one of the objects of a patent granted to me; yet, should the Society approve of it, I am willing to wave any advantage from it, in favour of the British public.

The construction of this pump is so simple and obvious, that it scarcely requires any explanation; but, should the

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Society require it, I shall be happy to attend the Committee appointed for its examination.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JACOB PERKINS.

The object of the peculiar modification of this pump is that of enabling sea-faring people to construct a pump while at sea from materials always to be found on board; viz. deal boards or planks, leather, nails, canvas, and tar.

This pump is constructed as follows: take four strips of deal boards of suitable width and length, nail them firmly together, so as to form a square trunk: this trunk is next covered entirely with tarpaulin; then another layer of boards is nailed over the trunk, observing to break the joints (see figs. 4 and 5, pl. XVII.) A third layer of boards nailed firmly to the first and second layer will complete the body of the pump, if of a common size (say 5 inches); but if the pump is larger, it may be strengthened by adding more layers of boards. For the form of the valves, see fig. 3. The substitute for the upper box of the common pump consists of two isosceles triangular valves the sides of which are double the length of the base, jointed with leather to two square pieces of boards (hard wood, if convenient). These two pieces of board, to which the valves are jointed, play diagonally in the pump (see figs. 1 and 2). Between these two pieces of board, is fastened with nails, the pump rod, which is also made of deal board: the leather which forms the joint should be extended over the sides of the valves, so as to form the stuffing as the valves lie obliquely in the angles of the pump. The inside of the valves may be loaded with sheet lead, if convenient; at any rate, they should be filled with as many nails as the valves will hold without weakening them. The upper

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valves are furnished with a check string (see fig. 3, valve B), to prevent the friction of the valves on the sides of the pump; this check, which may be made of small line, is very important to the ease of working the pump. It should be so adjusted as to prevent the valves from resting on the sides of the pump, the leather only should touch the pump. The lower valves, which are fixed to the bottom of the pump, are made similar to the upper valves, with the exception of the rod and check. Between the lower valves a piece of hard wood, for hooking up the valves, if no sheet iron or copper is at hand, should be fastened (see fig. 3, valve F).

This pump works very easily, owing to the water way by the valves being much greater than the water way through common boxes. It is not liable to choke, in consequence of the water not being *wire-drawn* below the boxes or valves; for the water way below the valves may be so contracted as to draw up even iron; but, by enlarging the bottom of the pump, this will be remedied.

References to the Engraving of Mr. PERKINS' *Ships' Pump,* Plate XVII.

Fig. 1, a side section of the pump.

Fig. 2, a diagonal section of ditto.

A A, body of the pump, figs. 1 and 2.

C C, pump rods.

D D, upper valves.

E E, lower valves.

Fig. 3, upper and lower valves; B the upper, F the lower valve.

Fig. 4, upper end of trunk.

Fig. 5, lower end of ditto.

The dotted lines mark the places in which the sections figs. 1 and 2 are taken.

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N° XVII.

DRAWING OFF THE BACK WATER FROM WATER WHEELS.

The smaller, or VULCAN GOLD MEDAL *was this Session presented to Mr.* JACOB PERKINS, *of Austin Friars, London, for a* METHOD OF DRAWING OFF BACK WATER FROM WATER WHEELS. *The following communication has been received from the candidate on the subject.*

Austin Friars,
March 8, 1820.

SIR;

I REQUEST that you will have the goodness to lay before the Society of Arts, &c., the inclosed communication relative to a method invented by me of drawing off the back water from water wheels.

This improvement in mills is that of using part of the superabundant water in times of floods, or freshets, to free the water-wheels from the back-water occasioned by such freshets. To effect this purpose, the following plans have been successfully adopted: Plate XIX is a view of a section of a water-wheel, and the system of forcing off the back-water, which accumulates in time of floods. A represents a water-tight tube, or trunk, being the breadth of the wheel, and the depth of the buckets, running from the bottom of the penstock, to or past the center of the bottom of the wheel. B is a receiving tube, or trunk, being one third larger than the small end of the

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tube A, and is also in a direct line with it. E is an opening between the tubes A and B; at this opening the back-water (which had accumulated under the wheel, while the current was cut off by the gate *a*), is carried off by the lateral velocity of the current, which rushes from the tubes A and B. C represents the back-water; D the bulk head. It will be readily seen, that, by opening the gate *a*, the water will rush down the tube A, and join the back-water at E, and with it, pass off through the tube B, under the bulk head D. The water expended in turning the water-wheel will also be carried off by the same current through the tube B. Plate XX, fig. 1, is a back view of a water-wheel, with the tube A running at right angles to it; but this modification is only used when the wheels are already built. Fig. 2 is a plan of the same. In this case the water is brought from the dam, or reservoir, by a curved channel, or otherwise, as may suit the situation of the wheels. The same letters of reference apply to the same parts in both plates.

I am, Sir,

A. Aikin, Esq.,
Secretary, &c. &c

&c. &c. &c.

JACOB PERKINS.

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N° XVIII.

SPRING LATCH.

The smaller, or VULCAN SILVER MEDAL *was this Session voted to Mr.* ALFRED AINGER, *of Everett Street, London, for a* SPRING LATCH. *The following communication has been received from the Candidate on the subject, and a Model of the Invention is placed in the Society's Repository.*

Everett Street,
March 16, 1820.

SIR;

I INCLOSE for the inspection and judgment of the Society of Arts, &c. an improved draw-back Spring Latch, the peculiar construction and advantages of which I shall be happy to explain to the Committee, on being duly apprized of the time appointed for its consideration.

I am, Sir,
&c. &c. &c.
ALFRED AINGER.

A. Aikin, Esq.,
Secretary, &c. &c.

In the construction of the lock described in the annexed engraving (plate XIV), the two following objects were proposed. In the first place, to render it more difficult of violation by a pick than those in general use; and in the second, to apply a key to it, of which no ordinary person could take an impress, and which, even in a workman's hands would be very difficult of imitation. Figs. 1

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and 2 represent a plan and section of the lock divested of the key, and of the springs which press the tumblers towards each other: *a a* is the plate or case of the lock; *b b*, the bolt which is moved by a pinion *c*, acting in a rack *d*; *e f* are the tumblers (of which four or more might be used, though two are sufficient to exhibit what are deemed the improvements). These tumblers have projections at their ends which dip into the grooves *g h* cut in the bolt. The projection of *e* (see fig. 2) is equal to twice the thickness of that part of the bolt in which the grooves are formed, but the projection from *f* is only half that quantity, in order to avoid in its passage the spring *i*, which is seen across the groove *h*, and whose situation under the bolt is described by a dotted line. The shape of the projection is shown at *k*, fig. 3: they are guided by the key through the grooves, as will be described; it is first, however, requisite to explain the nature and effect of the spring *i*. Fig. 4 shows the under side of the bolt with the grooves and the notches on a larger scale; it also exhibits the partial reduction of half its thickness, in order to contain the spring. The notches 1, 2, 3, 4, 5, 7, and 8, are similar in their nature and mode of action to the securities already applied to locks of various descriptions: it will be seen that the notches 2, 3, 4, 7, and 8, have a hook or beak not attached to Nos. 1 and 5. In the notch 8 this hook or beak is formed by a catch at the end of the spring *i*, so that it will recede towards 7 by a slight pressure on its beviled edge; its capability of doing this totally prevents the possibility of disengaging one tumbler from the notches at a time, which is the practice pursued in attempting to pick locks, and by which means the tumblers are removed from the situations in which the pressure of the springs places them, as is shown by the dotted lines in 3 and 7, and they are placed one after the other, as described in 4 and 8, in which position they offer

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no impediment to the motion of the bolt; but this effect cannot be accomplished in the notches 2 and 6, care being taken that the projection made by the spring be somewhat greater than that in the opposite notch. When this is the case, if, for instance, it was attempted to relieve the tumbler out of No. 2 first, it is evident it would fall in again before No. 6 could be disengaged, and the contrary mode is impossible, because, as soon as the pick ceases to act on the tumbler, its pressure would repel the spring, and it would again take its old situation.

The form of the key is described in figs. 5 and 6; the lower part of fig. 6, supposed to be a section showing the internal chamber, or pipe, in three divisions, the upper and lower being circular, and the middle one triangular: the use of these three parts may be better understood by referring to fig. 7, which is the pinion *c*, drawn on a larger scale: *a a* is part of the lock plate in which an iron pin is fixed; round this pin the cannon pinion *c* turns, having the lower part of its barrel circular, and the upper part formed of as large a triangle as can be inscribed in the circle, and having one side circular, as seen in fig. 1; immediately above, on the extremity of the iron pin, is fixed a similarly shaped piece of metal *m*, secured from revolving by a pin passing through it; when, therefore, the key is introduced, this part not turning with the rest, it requires that a second portion of the chamber should be cylindrical, to permit its remaining stationary during the motion of the key. To the lower extremity of the key are attached two irregularly curved collars *n* and *o*, fig. 5, each of which acts on one tumbler, and causes them, during the motion of the bolt, to describe curves similar to the grooves *g* and *h*. To prevent either collar from touching the tumbler for which it is not intended, a portion of each of the latter (being the upper part of one and the lower part of the other) is removed (See figs. 2 and 3).

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Fig. 8 describes the means of making a secret or master key on this principle: the lower part of the pipe (which is supposed to be manufactured in two lengths, and afterwards brazed together), is formed into an octagon and surmounted by a screw; the pieces *x* and *y*, similar in their nature to the collars before described, and having octagonal perforations, are to be slipped on to the pipe of the key, and followed by the screw nut *z*. The two lengths of the key, being then soldered or brazed together, the three pieces *x y* and *z* can never be lost, being secured from coming off by a small fillet *p*, which buries itself in a recess formed in the piece *x* for that purpose. The appearance of the key when the collars are on the octagon, and the nut screwed down, is described in fig. 9. Though the collars cannot be wholly removed, it is evident that by withdrawing them from the octangular to the cylindrical portion of the key, they may be turned round, and made to take any required position on the octagon; and if letters or figures were engraven on each of its sides, the collars might be withdrawn and returned to their places by the person acquainted with the secret, while to others there would be 512 chances to one against their being able to make use of it.

Figs. 10 and 11 exhibit the means of rendering a drawback lock as difficult to pick when on the first shoot as when double locked: *q q* is the bolt acted on by the spring *t*, and having the piece *s* attached to it; *r* is an inner, or secondary bolt, to which may be applied any species of security now in use for locks. It requires only to be made long enough to receive the apparatus for giving it such security, and therefore its length is not defined. It is connected with the bolt *q* by a stud holding in the piece *s*, thus permitting the latter to recede by striking against the staple, while the key-hole having

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communication only with the inner or secured bolt *r* there will be as much difficulty in picking it while on the latch or first shoot, as in other cases when double locked.

N° XIX.

MERCURIAL LOG-GLASS.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* C. H. JENNINGS, *of Carburton Street, Fitzroy Square, for a* MERCURIAL LOG-GLASS. *The following communication has been received from the candidate on the subject, and one of the Glasses is placed in the Society's Repository.*

25, Carburton Street, Fitzroy Square,
April 4, 1820.

SIR;

I HAVE the honour to send for the inspection and approbation of the Society, a Log-glass invented by me: it is intended to correct the errors constantly attending those at present used; the particles of sand with which they are generally filled being liable to cohere, particularly in damp weather, and thus to impede and even stop the performance of the instrument.

The present log-glass runs so as to answer for both the long and short glass; the former is used when the ship's rate of going is slow, the latter when she has great velocity. It is intended to be exhausted of air, so that no oxidation of the mercury can take place, nor will it be influenced by the expansion, &c. of the air, which is the case with the sand glasses. The fluid mercury runs

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equally and more correct than sand, which always forms a hollow cone as it is running.

Those glasses have been much approved by nautical men; they are manufactured by Messrs. W. and T. Gilbert, mathematical instrument makers to the Honourable East India Company, Leadenhall-street.

Should this instrument deserve attention, I beg it may be placed among those valuable instruments and machines in your repository, which are so honourable to this country and to the Society.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. H. C. JENNINGS.

Reference to the Engraving of Mr. H. C. JENNINGS'S *Log-Glass,* Plate XV.

Fig. 1, a section, *a a* the iron collar into which the two glasses *b b* are cemented; *c d,* two steel pipes fitted in the iron collar, so long as always to be above the surface of the mercury, and the glasses *b b* are so wide as to hold the mercury clear of the pipes in all positions: *e* the mercury, which is now running through the smallest aperture *c,* in 28 seconds (as marked on the glass, fig. 2); when inverted, the aperture *d* allows it to run in 14 seconds: *f,* a steel screwed mouth-piece to introduce the mercury, which may then be cemented up, or a valve may be applied and the glasses exhausted of air: *g* a steel cap to screw on to keep all safe. The glaases are secured by a horizontal circular piece of wood at top and at bottom, which are kept in their places by three screws *i i* which pass through the tubes or hollow pillars *k k,* one of which is shown in section: *l l* the screw nuts.

Fig. 2 shows the whole together, 14 and 28 being marked on the glasses: they are represented of one-third the real size.

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N° XX.

IMPROVED MUD-BOAT.

The large SILVER MEDAL *was this Session presented to Mr.* RICHARD PERING, *of his Majesty's Dock-yard, Plymouth, for his* IMPROVED MUD-BOAT. *The following communications have been received from the Candidate on the subject, and a Model of his Invention is placed in the Society's Repository.*

Plymouth Dock-Yard,
May 8, 1819.

SIR;

I HAVE to request you will do me the honour to lay before the Society of Arts, &c. a model of a boat fitted with apparatus, showing how an easy and quick discharge of mud, &c. may be effected, without the usual practice of the men being under the necessity of standing in the midst thereof, to discharge it by scoops or shovels.

On the 30th July, 1817, I proposed to the Honourable Navy Board to fit a boat for this purpose, which was ordered; it was tried on a vessel of twelve tons, and being found to answer, one of twenty-four tons was also fitted with lifting buckets, both of which are in daily use—another of fifty tons is now nearly finished.

The discharge of the cargo is so quick, that although the boat may be aground, she will lighten much faster than the fall of tide, consequently may always be hauled off. In close harbours, where great deposits take place, and it is necessary that they should be cleared, boats so fitted may be useful. The uprights and boom by which the buckets are lifted may be lowered at pleasure; the boat may be rowed, towed, or sailed.

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Herewith you will be pleased to receive certificates of its being effectually employed.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. R. PERING, *Clerk of the Checque of his Majesty's Dock Yard, Plymouth.*

CERTIFICATES.

Plymouth Yard,
August 24, 1819.

SIR;

THE model of the Mud Boat constructed according to your invention, and in use upon a small scale at this yard having been examined by us, we think it right to express our satisfaction and approbation of the plan, conformably to which we shall direct the officers to build a boat of proper dimensions for the use of this port, and to send a model of the same to the Navy Office, to submit to the inspection of the Board.

We are,

&c. &c. &c.

(Signed) T. B. MARTIN.
R. SEPPINGS.
P. FRASER.

(A Copy) W. GADWELL.

Plymouth Yard,
May 7th, 1819.

SIR;

I BEG leave to inform you with respect to the new planned Mud Boats, that in my opinion they are very beneficial to his Majesty's service, being unloaded in half the time with the same number of men that a boat takes of the same tonnage on the old plan; they are also of

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great benefit to the men employed on that service, as the unloading is now performed with much greater ease and cleanliness. The discharging of the old mud boats would often envelope the men completely in mud, whereas the new planned boats with tubs, are unloaded without the least filth whatever.

N. DUNFORD, *Foreman of Scavelmen.*

Rich. Pering, Esq. Clerk of Checque.

References to the Engraving of Mr. RICHARD PERING'S *Mud Vessel,* Plate XVIII.

Fig. 1 is a side view of the vessel, having the two middle buckets elevated to a position proper for delivering the mud.

Fig. 2 is a cross section, and fig. 3 is a plan or view on the upper side of the vessel with the two middle buckets in the same position as in fig. 1.

Fig. 4 is a side view of the wheels or crane for elevating the buckets.

Fig. 5 is a side view of the catch wheel, roller, &c., for retaining the block and pulley perpendicular between the two buckets which are to be elevated.

Figs. 4 and 5 are shown in the same situation as in fig. 1, but on an enlarged scale.

The same letters of reference refer to the same parts in each figure.

A A, a boat or vessel something similar to those formerly used for removing mud, &c. But in place of filling the middle part of the vessel with mud, I have fitted it up with six buckets B B B, &c., (to retain the mud), which turn on hinges or joints *a a*, &c. fixed on the upper edge of the boat; C C, two uprights or posts,

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having a pulley *b b* fixed in the upper end of each, over which the ropes pass to elevate the boom, or beam D, which is supported by brackets fixed to the uprights C C. The uprights and boom can be erected and lowered at pleasure; on the boom D is suspended a block *c*, which may be slidden from one end to the other, and retained in any required position by the chain *d*, one end of which is fixed to the block *c* and the other to the roller *e*; at one end of the roller *e* is fixed a catch wheel, having a catch *g* acting in it to retain the block *c* perpendicular between the two buckets which are intended to be emptied. A winch also is fixed on each end of the axis of the roller *e*. To the under part of the two buckets opposite each other is fixed a chain *h h*, having a loop or link *i* sufficiently large to prevent the chain dropping between the two buckets when lowered to their situations for loading.

When the buckets are to be emptied, one end of the chain *j*, which passes over the pulley in the block *c*, must be hooked into the loop *i*, the other end of the chain *j* being previously fixed to the roller *k*; then, if the winches or handles *l l* be turned, motion will be given to the pinion *m*, which is fixed on the same axis; the pinion *m* gives motion to the wheel *n*, which is fixed on the same axis as the pinion *o*; the pinion *o* works in or gives motion to the wheel *p*, which is fixed on the end of the axis of the roller *k*, to which the chain *j* is fixed; when the buckets are to be lowered, the brake *q* (which acts against the periphery of the wheel *p*) must be pressed against the wheel *p* by the lever *r*; the pole *s* must be lifted up, and the axis on which the pinion *m* is fixed, must be drawn longitudinally, till the pinion *m* is out of gear with the wheel *n*; then the velocity of the buckets going down may be easily regulated by the lever *r*; a chain *t t* is likewise fixed to the two buckets to prevent them from being overturned.

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N° XXI.

APPARATUS FOR THOSE WHO HAVE LOST AN ARM.

The smaller, or VULCAN GOLD MEDAL *was this Session voted to* CAPTAIN GEORGE FITZGERALD STACK, *54th Regt., Thayer Street, Manchester Square, for his* APPARATUS FOR THE USE OF THOSE WHO HAVE LOST AN ARM. *The following communication on the subject has been received from the candidate, and the Apparatus is placed in the Repository of the Society.*

8, Thayer Street, Manchester Square,
January 17th, 1820.

SIR;

HAVING lost my arm in the Peninsula, I have since experienced the greatest difficulty in keeping writing or drawing paper sufficiently steady either to cut, rule, rub with india rubber, fold or seal letters, &c. &c. The duty of an officer requires that he should write in the soldiers small account books to the number of near a hundred every month, which duty I found it impossible to perform without the assistance of a second person to keep the books open. The small weights commonly in use for the above purposes, only press on the center of the paper, by which the sides are lifted up, throwing a shade on it very troublesome, and also causing a great delay, as the pen must be laid down every time the weight requires to be changed. There is not any instrument in use that can

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take *instantaneous* hold of a pen, pencil, or other article, when let go by a person who has lost the arm *above* the elbow joint, the common vice requiring a second hand to turn the nut. I have, in order to obviate as much as possible the before-mentioned difficulties, invented an apparatus, on which I improved, and now find that it answers all the purposes required at a writing-table.

The pincers (which act as a pen-holder, &c.) are also of great use to me in various other ways, and particularly so at a dressing-table. I now take the liberty of laying the said apparatus, with drawings of it (which I have been enabled to execute), before the Society for the Encouragement of Arts, &c., and shall feel highly gratified if it meets with their approbation. I beg also to say, I shall be most happy to attend in person to give any explanation that may be necessary.

The invention of Mr. T. Lane,* although certainly very ingenious, and highly useful to any body who has lost only a *hand*, is not of the least use to me; neither can the pen-holder increase or decrease the pressure instantaneously.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEO. FITZGERALD STACK,

Capt. Half-pay, 54th Regt.

Reference to the Engraving of Captain STACK'S *Apparatus,* Plate XXI.

Fig. 1 represents the entire apparatus, attached to a table, and ready for use.

Fig. 2 is a bird's eye view, and fig. 3 a horizontal view of the ruler, the vice, and parts attached to them; the

* See Vol. 36, p. 74.

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same letters of reference indicate the same parts in all the figures.

a, the ruler, formed of a steel plate, from nine inches to a foot long, one inch and a quarter wide, and one-eighth of an inch thick. It is pierced by five holes on each side; *b b*, &c. inserted near the edges for the purpose of fastening a piece of glove leather to the under surface, in order to prevent the paper, &c. from slipping. A scale of parts is to be engraved on the ruler. One end of the ruler is cut off at right angles to the sides, the other terminates in a joint *c*, by which it is attached to the vice.

e, the vice, secured to the table by means of the screw *f*, and united with the ruler by the joint *g*, which is secured by the screw *h*.

i, a strong spring inserted into the ruler by a rivet passing into the hole *k* and capable of being tightened or relaxed by the screw *l*, which works in the hole *m*; the use of the spring is to cause the ruler to press firmly on the paper or book which is beneath it.

n, a lever, hooked at one end, and fastened at the other end by means of a small screw into the hole *o* of the ruler: near the middle of the lever is a transverse hole *p*, through which the screw *q* passes, and thus serves as a fulcrum to the lever, at the same time securing it in its position by passing into the hole *r* of the vice.

s, a square socket in the vice *e*, which receives the short leg of the pen-holder, fig. 7, and is commanded by the attached screw.

Figs. 6 and 7, a spring pincers called the pen-holder: the jaws are formed so as to receive pens and pencils without crushing them. The jaws naturally stand open in consequence of the action of the spring, and the width of their gape is limited by the screw and nut *t*, which also serves to keep them permanently closed when required.

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Fig. 8 is a pointed cylindrical piece of wood to be inserted into the barrel of the pen previously to its being nibbed, as shown fig. 1.

v, fig. 1, is a walking stick, to the thicker end of which is fastened a cord having two rings, one *w*, at one end of the cord, the other *x*, a few inches from the same end; the ring *x* receives a hook fixed to one end of a piece of strong catgut *y*, which at the other end is furnished with a loop that goes on the hook of the lever *n*, and thus enables a person, by pressing on the walking stick with his foot, to raise the ruler *a*, and disengage the book or paper beneath.

The terminal ring *w* is secured in a swivel, shown at large, fig. 5, to the other end of which is also fastened a piece of catgut, which passing over the little pulley *z*, is fastened by means of the knot which terminates it, in the notch *z*, of the longer leg of the pen-holder, the jaws of which are closed by pressing with the foot on the stick *v*.

Fig. 9, a walking stick, pointed at one end, to fix in the ground, and furnished at the other with a square socket to admit the short leg of the pen-holder when the apparatus is used in camp or in the field. When the use of a table can be obtained, the stick then acts the part of a treadle, as *v*, fig. 1.

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Nos XXII, XXIII, XXIV, AND XXV.

NAVAL IMPROVEMENTS.

The GOLD MEDAL *of the Society was this Session presented to Mr.* W. HOOKEY, *Master Shipwright's Assistant, Woolwich Royal Dock Yard, for the several* NAVAL IMPROVEMENTS *which form the subject of the four following communications. Models of the improvements are placed in the Society's Repository.*

Woolwich Yard,
Jan. 27th 1820.

SIR;

I HAD the honour of addressing a letter to you some time since, in order to claim as my own invention, a plan laid before the Society by another person, relative to the construction of ships' and boats' rudders; I now beg to present to the Society models of my rudders, which I have adapted ever since the year 1813.

Before I employed this plan, I had convinced myself that generally the rudders of all vessels are much too heavy, so that in fact the rudders incur weakness by that which was intended to give them strength, as their great weight destroys, or has a tendency to destroy, the pintles and braces which are their only security. I therefore reduced the weight of the rudder very considerably, and by attaching it in the manner shown in the models, I increased its power, the effect being thus rendered sensible the moment the tiller is moved from the middle line.

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According to the former plan, large scores were cut in the rudder below the surface of the water, and a great vacancy was left between the rudder and vessel, whereby much water escaped, and the tiller was in consequence obliged to be put over considerably before the effect was felt, and by this means a great body of water was carried along, which must necessarily retard the rate of sailing. That much power must necessarily be lost in the way I have described, will be obvious, if we consider what would be the effect of boring great holes in the rudder; in this case it is evident much fluid would escape without producing any effect; and just in the same way does the water, as I have described above, escape between the vessel and rudder. My object has been to follow nature as nearly as possible; and looking to the tail of a fish for my example, I have endeavoured to construct my rudder to operate in the same manner. How far I have succeeded is not for me to determine; but on this head I cheerfully leave my claims in the hands of gentlemen in every way competent to judge of the merits of my construction, and shall only add that I have the honour to remain,

Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.
WM. HOOKEY,
Master Shipwright's Assistant.

Reference to the Engravings of Mr. HOOKEY'S *Improved Rudders,* Plates XXII, XXIII, and XXIV.

Plate XXII represents Mr. Hookey's method of constructing the rudder and stern post of a boat.

Fig. 1 is a side view of the stern-post and ruder, as formerly constructed.

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Fig. 2 is a horizontal section of the above.

Fig. 3 is a side view of the stern-post and rudder on Mr. Hookey's improved principle.

Fig. 4 is a horizontal section of the above.

Fig. 5 is an end view of the stern and stern-post, without the rudder.

Fig. 6 is an edge view of the fore part of the rudder.

a a is the false stern-post, having a circular groove in the after part, to receive the rudder, the fore part of which is cylindrical; by which means the water is prevented from entering between the stern-post and rudder, which adds power to the rudder, and does not retard the boat, as will be seen by comparing it with figs. 1 and 2; if the rudder is separated from the stern post, the way of the boat will be retarded in proportion as the area of the rudder is to that of the boat.

b is a chuck to prevent ropes from getting between the stern-post and rudder; the groove in the stern-post is a guide for directing the pintles into the braces, when shipping the rudder.

c is an eye-bolt for a man to take hold of, in case of his being near the rudder when fallen overboard by any accident.

Plate XXIII represents the stern and rudder of a merchant ship.

Fig. 1 is a side view of part of the stern of the vessel and the rudder.

Fig. 2 is an end view of the stern and stern-post, without the rudder.

Fig. 3 is a side view of the rudder.

Fig. 4 is an edge view of the same.

a is a circular piece of oak, secured by screw bolts, by which means the rudder is very easily hung or unhung, when the ship is in dock, or afloat.

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b b are two chucks with a brass collar, which acts as a pintle, and also prevents the rudder from being unshipped.

c is an iron tiller, at the after part, if there is room to use it; if not, of course at the fore part.

Plate XXIV represents the stern and rudder of a 1,600 tons ship.

Fig. 1 is a side view of part of the stern of the vessel and the rudder.

Fig. 2 is a plan of the above.

Fig. 3 is an end view of the stern and stern-post, without the rudder.

Fig. 4 is a horizontal section, at the level of the dotted line *z z*, of the deadwood and rudder.

Fig. 5 is a side view of the rudder.

Fig. 6 is an edge view of the same.

Fig. 7 is a plan, and

Fig. 8 a section of the lower braces which receive the pintle of the rudder; the lower pintle to be five inches in diameter, and made of gun metal.

In figs. 9 and 10, *a* and *b* are two blocks or stops, to prevent the rudder from being unshipped; which are fixed to the false stern-post below the two upper braces.

Fig. 11 is a view of the upper side of figs. 9 and 10.

c c, two cheeks, one on each side, well secured to the spindle; by which means smaller timber will make a rudder, and is more easily obtained than larger.

d d, ring-bolts, one on each side, which answer two purposes, namely, for hanging the rudder, and, by crossing the chains, act as rudder pendants.

f is a chuck, to prevent ropes getting between the rudder and stern-post, and also serves as a guide for hanging the rudder, when the ship is afloat, and it likewise supports the lower brace.

g is a false stern-post, with a semicircular groove, to

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receive the fore part of the rudder, which is made cylindrical; by which means the water is prevented from entering between the stern-post and rudder, which adds power to the rudder, and does not retard the ship.

h is an additional pintle, fixed at the top of the rudder, and secured by a strap of iron passing athwart-ship, which is firmly secured to the chucks fixed round the helm-post.

N° XXIII.

Woolwich Dock Yard,
Jan. 27th, 1820.

SIR;

I BEG to lay before the Society of Arts, a method which, from the long experience I have had in ship and boat building, I have no doubt would be found highly useful in replacing a rudder carried away in a gale of wind, or by other accident, a model of which temporary rudder I have the honour of transmitting with this letter.

By reference to this model, it is obvious that no stuff is required in its construction but what may be immediately supplied in men of war, from the hammock boards and the men's mess tables, together with a spare anchor stock; and in merchantmen recourse must be had to spar or yard, and any bulkhead or platform stuff, that can be the best spared for the purpose: three pintles, which must be kept in reserve, will be the only additional expense of lumber requisite to be taken on board to provide against so serious an accident, which has undoubtedly been the occasion of the loss of many a valuable vessel, and of the lives of many hundred of human beings.

I am, Sir,
&c. &c. &c.
WM. HOOKEY,
Master Shipwright's Assistant.

A. Aikin, Esq.
Secretary, &c. &c.

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Reference to the Engraving of Mr. HOOKEY'S *method of constructing temporary Rudders,* Plate XXV.

Fig. 1 is a side view of a temporary rudder for a 74 gun ship, part of the planking being removed to show the manner of its construction.

Fig. 2 is a horizontal section of the above.

Fig. 3 is an edge view of the fore part of the rudder and pintles.

Fig. 4 is an edge view of the after part of the rudder.

a a, two cheeks (secured to the spindle *b*, or main piece), which it is proposed to make of the spare anchor stocks.

c c is the middle planking, which is fixed at right angles to the spindle, and which is to be made from the men's mess tables; to each side of these are fixed planks *d d*, at right angles to those of *c c*, and which are to be made from the hammock boards; to each side of these are fixed planks *e e*, in an oblique direction: on one side of the rudder the planks are directed upwards, and those on the other side downwards (which are likewise made of the men's mess tables), which prevents the rudder from racking, when secured all together with the tree-nails and nails.

f f are iron braces, which are fixed at one end to the cheeks *a a*, and the other ends are fixed to the after part of the rudder, they cross each other, and thus prevent the rudder from racking.

g g are ropes fixed to the after part of the rudder, to assist, if necessary, in steering the ship, by tackles being brought to them.

Fig. 5 is a side view of a merchant ship's temporary rudder, having part of the planking removed to show its construction.

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Fig. 6 is a plan of the above.

Fig. 7 is an edge view of the fore part of the rudder and pintles.

Fig. 8 is an edge view of the after part of the rudder.

h h, the spindle, made from a spar or yard; to each side are fixed cheeks *i i*, wound tight with rope, in case there are no iron hoops on board.

j j are two thicknesses of planking, lengthways of the rudder, which may be made from any platform stuff below; to each side of these are fixed planks *k k*, in an oblique direction.

l l are scores, cut out in the wake of the braces under water.

N° XXIV.

Royal Dock Yard, Woolwich,
Jan. 24th, 1820.

SIR;

I BEG to lay before the Society of Arts, &c., the model of a machine intended to answer the double purpose of becoming a spare Topmast Cap, and for forming boats' timbers and knees, in order to repair boats when ships are at sea, or in a foreign port.

By means of this machinery, boats' timbers and knees may be made out of straight timber; they possess the important advantage of being light and strong, 38 knees being formed out of two cubical feet of timber.

I practised this method for four years while master boat-builder in Woolwich Dock Yard, and never in a single instance knew of any one breaking. With an entire confidence in the discriminating judgment of the Society, and in their liberal encouragement of every useful invention,

I am, Sir,
&c. &c. &c.
WM. HOOKEY.

A. Aikin, Esq.
Secretary, &c. &c.

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Reference to the Engraving of Mr. HOOKEY'S *method of bending and forming Boats-knees and Timber out of straight Timber.*

Plate XXVI, fig. 1, is a view of the upper side of a block of wood, intended as a spare topmast-cap; in each side of which grooves are cut, to the curve and form of the knees and timber required; those on the under side of the block are represented by the dotted lines.

Fig. 2 is an edge view of the above.

Figs. 3, 4, 5, and 6, represent the knees or timbers as formed in the above block.

Figs. 3 and 4 have chucks made on different principles to form the knees.

a a are wedges, to set the knees or timbers into more or less compass.

b b indicate the place of the square and round holes which may be made in the block, for the mast-head and topmast, but they are not to be cut out till wanted.

Fig. 5 are cutters' and gigs' bent timbers, but which had been bound round with a rope yarn, when in a straight state, and were bent altogether in the groove marked *c c*, of fig. 1.

d, an end view of the timbers.

N° XXV.

Woolwich Dock Yard,
Jan. 27th, 1820.

SIR;

I BEG to present to the examination of the Society of Arts a drawing of a Chain Beam which I have projected for the purpose of strengthening merchant vessels, while at the same time it facilitates the loading and unloading in a very considerable degree, particularly of ships with cargoes of timber. As the drawing which accompanies

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this letter, will render the application and operation of this beam much more obvious than any written description which I can give, I shall merely observe, that it may be taken up and replaced in a few minutes by any two sailors or labourers, by means of the screws shown in the figure; I may, however, be allowed to make a few observations on the utility which I imagine will accrue from the application of this principle. In the first place, it will be found of great advantage in stowing and unstowing the ship; 2ndly, it will prevent the cargo from shifting when the vessel is not full stowed; and 3rdly, with a full cargo it will prevent the vessel from expanding and foundering in a heavy sea, or when on shore, and gives additional strength. I beg leave farther to observe, I have fitted beams of the above description to several navy transports, which have been highly approved of by the respective captains; one of those vessels went to Pletenberg Bay, round the Cape of Good Hope, for timber; and in this case in particular, great advantage was derived from the application of the beams.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.

WM. HOOKEY,
Master Shipwright's Assistant.

P.S. It is much to be regretted that in a great commercial nation like England, year after year is allowed to pass over our heads without producing any solid improvement in the construction of our merchant vessels. When we examine the melancholy lists posted daily at Lloyds, it is impossible not to reflect that many of the losses, not only in property, but of the valuable lives of our brave sailors, have been sacrificed by faulty constructions; which, if corrected, would give more confidence to our merchants to embark their property, more comfort and

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security to our navigators, and save the useless tears and lamentations of many a widow and orphan. If what I have now had the honour of submitting to the Society of Arts should tend towards the attainment of this desirable end, it will be to me a source of the highest gratification.

Reference to the Engraving of Mr. HOOKEY'S *Chain Beams, for the Preservation of Ships with large Hatchways and deep Holds, without Beams, when on shore, and also when rolling in a heavy sea, and which are of very great advantage in stowing the Hold, and preventing the cargo from shifting.*

Plate XXVII, fig. 1, is a cross section of a vessel. The same letters referring to the same parts in each figure.

A A, riders of iron, with eyes forged on them, to couple the chain to; these riders are firmly fixed to the sides of the vessel with bolts.

B B, two chains, coupled to the two iron riders by means of two shackles and bolts; to the other ends of the chains are coupled, by means of another pair of shackles, two long links, one end of each having a female screw, which receives the screwed pin *c*, the opposite ends of which are formed into a right and left handed screw, in the center of which is an eye, into which is introduced a lever for turning it; which, if turned in one direction, makes the two links advance towards each other, and tighten the chain; and if turned the other way, has the contrary effect.

Figs. 2 and 3, two views of the links, shackles, and screw, to an enlarged scale. The screws are one foot long at each end; their diameters depend on the tonnage of the ship; for instance, 1¼ inch for a 400 ton ship.

D is a shifting beam or strutt, which is placed alongside of the chain, and prevents the sides of the vessel

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being drawn together by overscrewing the chain; but it will depend on the sort of cargo the ship may be loading with, whether or not the wooden beams will be put in.

Fig. 4 is a plan or view on the upper side of the main hatchway, showing the manner in which it is secured by the iron straps and screws.

E E, two straps, firmly secured to the under side of the short beams F F.

G G, two pair of links and screws, similar to the one already described for tightening the chain, which are coupled to the two straps E E, by means of the open ended links and pins; two views of which are shown by figs. 5 and 6, to an enlarged scale.

Strutts are introduced in the commings of the hatchway, opposite to the ends of the beams, which prevent the chains from being overscrewed.

Fig. 7 is a plan or view from the underside of the main hatchway, being another method of preventing a ship from expanding, by two chains being frapped or drawn in *taught*, by means of a pair of double blocks, or a purchase; and two small chains passed round it, with a hook at each end, to secure the chains when drawn up.

H H, two chains, which ought first to be stretched across the vessel as *taught* as possible, and the ends be coupled to two straps firmly bolted to the sides of the ship.

I, a pair of double blocks, hooked on the middle of the chains; which, when sufficiently drawn in, are to be secured by the small chains K K.

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N° XXVI.

PROPELLING SHIPS OF WAR.

The smaller or VULCAN GOLD MEDAL *was this Session voted to Captain* JAMES BURTON, *R. N., Portsmouth, for a method of* PROPELLING SHIPS OF WAR. *The following communication has been received from the candidate on the subject, and a Model of his Invention is placed in the Repository of the Society.*

Salopian Coffee House,
February 16, 1820.

SIR;

I TAKE the liberty of requesting you to have the goodness to submit to the Society for the Encouragement of Arts, Manufactures, and Commerce, my plan and model for propelling ships in a calm; and also by means of the same machinery of working the chain pumps on the principle of a water-mill, when the ship is moving through the water.

I beg to observe that it has met the highest approbation of my Lords Commissioners of the Admiralty, as well as of the numerous officers and scientific men who witnessed its trials. I inclose the official reports made thereon, and will do myself the honour of attending in person to explain the invention to the Committee. I shall be obliged to you to fix an early day for this purpose, as I am on the eve of leaving England.

I am, Sir,

&c. &c. &c.

JAMES BURTON, *Captain in the Royal Navy.*

A. Aikin, Esq.
Secretary, &c. &c.

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CERTIFICATES.

Ramillies, in Portsmouth Harbour,
May 12, 1819.

SIR;

HEREWITH I transmit for their Lordships information, a letter from Captain Sir James Gordon, stating that a trial of the machinery for rowing the Active was made this day, and expressing a desire to make a further trial thereof, by proceeding in the ship to Spithead by the machinery, on Saturday next, or the first favourable day afterwards.

In submitting this I beg you will acquaint their Lordships that I was on board the Active during the whole of the time this trial was made; the ship was propelled by the machinery a considerable distance down the harbour, and fully sufficient, in my opinion, to ascertain its perfection and utility; and I beg to add, that I agree in opinion with Sir James Gordon, that the ship may be removed to Spithead by it without risk or difficulty, provided the tide is not too powerful (there not being sufficient water until about half flood); and if their Lordships approve thereof, I will order the trial to be made on Saturday next, or the next favourable day afterwards.

I am, Sir,
&c. &c. &c.

John Wilson Croker, Esq. A. P. HOLLIS, *Commodore*

His Majesty's Ship Active, in Portsmouth Harbour,
May 12, 1819.

SIR;

I HAVE the honour to acquaint you that a trial was made this morning of the machinery for rowing the Active, which has been fitted on board, and I have great pleasure in stating that it fully equalled my expectations.

The weather was moderate with a young flood tide; one hundred and eighty men were employed at the three

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different capstans, and with this force the Active was propelled through the water with a light air on the beam, and against the tide (which was running full half a knot) at the rate of nearly two miles and a half an hour; and I have no hesitation in saying, that in my opinion, under similar circumstances of weather, this ship may be propelled to Spithead by this machinery without risk or difficulty; and I should very much wish, provided it meets their Lordships' approbation, to make a further trial by proceeding in the ship to Spithead by the machinery, on Saturday next, or the first favourable day afterwards.

I am, Sir,
&c. &c. &c.

Commodore Hollis. J. A. GORDON, *Captain.*

Ramillies, in Portsmouth Harbour,
May 16, 1819.

SIR;

I TRANSMIT for their Lordships' information, a letter from Captain Sir James Gordon, of the Active, detailing the particulars of the experiment which took place yesterday, of propelling that ship to Spithead, by means of the rowing machinery fitted on board; and having been present during the operation, I beg to remark that I am fully of opinion that the ship might have been taken to Spithead, but for the impediment of the wind and tide, as expressed in Sir James's letter; and having now given the machinery a fair trial, I have directed the Active to proceed to Spithead with the fair wind; and which I trust will meet their Lordships' approbation.

I am, Sir,
&c. &c. &c.

J. W. Croker, Esq. A. P. HOLLIS, *Commodore.*

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His Majesty's Ship Active, in Portsmouth Harbour,
SIR; May 15, 1819.

I HAVE the honour to report to you that the weather being moderate this morning, with a light air from the southward, and deeming it practicable to take the Active to Spithead, by the rowing machinery; the moorings (which are abreast of the Prince, above the Dock-yard), were, by the desire of the pilot, slipt at 24 minutes before 11; the ship began to move in about half a minute after the capstans were set in motion, the paddle wheels at first making about six revolutions per minute; at 10 minutes past 11 the ship was abreast of the King's Stairs, going at the rate of two knots, with the wind right a-head and freshening, and the tide running in about half a knot, the wheels then making eight revolutions per minute; at 14 minutes before 12 the ship was abreast of Point, going barely two knots, the wheels making the same number of revolutions, and the wind gradually increasing, and the tide running about one knot and two fathoms by the common log: at 25 minutes past 12 the ship was a-breast of the eastern part of the platform, going a knot and a half, the wheels making the same number of motions. The tide having increased to a knot and a half, and the wind also increasing, and observing the Camelion under weigh at Spithead, I demanded by telegraph her rate of going, and received for answer, "5 miles." I did this with a view of ascertaining the probable resistance the ship met with from the force of the wind being right a-head.

The ship having been propelled thus far by the machinery against wind and tide, which were both increasing, and finding that she made but little progress, it was deemed prudent, in preference to anchoring there, to drop her into the harbour, where she now is ready to take advantage of the first fair wind to sail to Spithead.

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I beg to observe that the experiment of this morning has proved in my mind the capability and utility of the machinery, which has fully equalled my expectations, and I have no doubt, but from the impediment of wind and tide, that the ship might have been taken to Spithead with safety.

I cannot, in justice to Lieutenant Burton (the inventor), close this letter without bearing testimony to his zeal, assiduity, and attention, which has been unremitted during the whole time he has been here.

I am, Sir,

&c. &c. &c.

Commodore Hollis. J. A. GORDON, *Captain.*

His Majesty's Ship Active, Halifax Harbour,
October 18, 1819.

SIR;

HAVING, with the permission of the commander in chief, got under weigh, for the purpose of taking the ship round George's Island by the propelling machinery, I have the honour to inform you for the information of my Lords Commissioners of the Admiralty, that, with the exception of one or two keys dropping out which connected the rigger wheel, which was the cause of an arm giving way, it answered exceeding well, and that, when the ship was wore to return to her anchorage, she moved at the rate of 3½ miles per hour, the paddle wheels making eleven revolutions per minute: there was a light air from the southward during the whole time the ship was under weigh.

After the last trial in Portsmouth harbour, the whole of the machinery, or rather the paddle wheels, were stowed away; and was the ship in chace and a calm coming on,

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the paddle wheels could be put together and ready for working much sooner than the boats could be got out.

I am, Sir,

&c. &c. &c.

J. A. GORDON, *Captain.*

Reference to the Engraving of Captain JAMES BURTON'S *Method of Propelling Ships, and working the Pumps,* Plate XXVIII.

Fig 1 is a plan of part of a vessel, the planking of the decks being removed for the purpose of showing the machinery.

Fig 2 is a cross section of part of the vessel at the shaft which works the paddles.

Fig 3 is a view of part of one side of the vessel, showing one of the paddle wheels.

Fig. 4 is a longitudinal section of fig. 1, through the center of the vessel.

The same letters refer to the same parts in each figure.

There are three circumstances in which the application of the machinery about to be described will be found advantageous; first, in propelling the vessel when she is becalmed, or is on a lee shore, by applying the men at the capstans, as the power for working the paddles; 2nd, in working the chain pumps, by the application of the men alone to the capstans; 3rd, in the application of the paddle wheels as a power, to work the chain pumps when the ship is under sail, and in a leaky state.

a a is a horizontal shaft of cast iron, reaching across the vessel; on each end of the shaft is fixed a cast iron wheel or frame *b b*, in which are eight mortices to receive the wrought iron arms *c c*, that carry the floats *d d*, &c. of

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the paddle wheels; these arms may be fixed into the mortices in the frame, by means of keys or set screws, or otherwise, as may be most convenient for unshipping them: the extremity of the floats of each paddle wheel is connected together by means of two sets of light stays or braces of wrought iron: *e e* is the ship's capstan, to the lower end of the axis of which is fixed a wheel or rigger *f f*: *g* is an additional capstan, on the upper end of which is fixed another wheel or rigger *h*, the upper face of which is formed into a cogged bevil wheel.

The power is communicated from the capstan *e e* to the capstan *g*, by means of an endless chain passing round the two riggers *f* and *h*, which chain is conducted, and prevented from swagging by the rollers *j j j* which are suspended to the beams of the vessel. The bevil wheel *i* works into the bevil pinion *k*, which is fixed on the shaft *a a* and gives motion to the paddle wheels, when the vessel is becalmed, and is intended to be propelled by the power of the men applied to the capstan bars. If the men are required to work the pumps, the pinion *k* must be thrown out of geer, by sliding the pinion endways on the shaft, and the floats of the paddle wheels must be unshipped; the pinion *l* must then be thrown into geer with the wheel *i*: on the other end of the shaft on which the pinion *l* is fixed, is a spur wheel *m* which gives motion to the two spur pinions, fixed on one end of the shafts or spindles *o o*, on the other ends of which are the riggers *p p*, that work the chain pumps *q q*.

But should the vessel be leaking more than the men at the capstans are able to keep under, the paddle wheels must be rigged out, and the pinion *k* likewise be thrown into geer with the wheel *i*, by which means the pumps may be worked when the vessel is under sail, by the action of the paddle wheels alone, as a power, without the

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assistance of any men at the capstans, or if the ship's way is not sufficient, the men may also be employed at the same time.

N° XXVII.

SAFE COACH.

The GOLD MEDAL *was this Session voted to Mr.* OBADIAH ELLIOTT, *of Westminster Road, for a* SAFE COACH. *The following communication on the subject has been received from the candidate, and a Model of the Coach is placed in the Repository of the Society.*

Westminster Bridge,
Feb. 23rd, 1820.

SIR;

IN submitting to the consideration of the Society for the Encouragement of Arts, &c., my new invented Life Preserver or Safe Coach for travelling, I beg to be indulged in a few observations, and at the same time to solicit, should it really be found deserving thereof, the honour of their patronage and approbation.

I flatter myself, upon examination, this coach will be found far superior, with all the combined advantages it possesses, to any thing ever yet introduced to their notice, as every reasonable objection that has been advanced to the generally adopted method of building stage coaches, is by this invention removed.

This coach is superior to those at present in use, not

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only as it regards general safety, but is also much lighter and easier of draught, and the principal weight is placed, and the body itself, hung so low, as to render it utterly impossible to turn over, under any circumstances however unfavourable.

It is easier of draught by the proportion of more than one horse to four, which proceeds from two causes; first, that, whereas the fore wheels of the coaches now used, erroneously termed safety coaches, are but 2 feet 8 or 10 inches high (which instead of diminishing the labour, does absolutely require, and particularly in wet weather, the additional power of two horses, while they wear out a pair of wheels in one week); my fore wheel is nearly as high as the hind one, and the coach itself it shorter by 14 inches, than any other. Secondly, it is lighter by above 3 cwt., though I have made very large wells for luggage (larger than is perhaps requisite), on account of the whole of the perch, carriage, iron work, &c., being entirely dispensed with.

With regard to safety, the first advantage peculiar to this coach alone, is, that the front part in which the outside passengers and coachman are seated locks round, so as to be always in a right line with the horses; hence those accidents will be prevented which but too frequently occur, from a sudden start or turn to the right or left.—Further, it is so contrived, and the springs are so fixed, that if one or all were to break at once, the body would drop but a few inches, and could, without inconvenience, proceed on the remainder of the journey.—Again, if the axletrees were to break, and all the wheels come off, the body would fall but 18 inches;—or, which is much more probable, should, either the fore, or hind wheel, or both, by neglect of proper attention, come off, the center of gravity is so near the center of action, that the body would only fall on an

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incline of 7 or 8 inches at most, and could not possibly overturn.

In this coach, all the lesser conveniences and comfort so desirable, are also attained, and the most infirm persons will not experience the least difficulty in getting out of and in their places.

For the practical proof of the above observations I can answer, as I have built a coach at very considerable expense (which may be seen at my manufactory), and in trying the experiment with the hind wheel off, found it required the strength of five men to turn the body on its side, which, from the revolving system of its construction, was done while the front part remained stationary and unincon-venienced.

With respect to the mode more generally adopted within these few years, of fixing the luggage underneath, I beg leave to say, that as for nearly 20 years I have been in the habit of fixing to the bottoms of all the carriages I have built without a perch, luggage boxes or wells, which I term sub-imperials, I hope I may be permitted to claim, as peculiarly my own, the origin of that method, since applied by Mr. Milton to the Reading and other coaches, under the idea of improvement.

I am, Sir,

&c. &c. &c.

OBADIAH ELLIOTT, *Coach-Maker.*

Reference to the Engravings of Mr. OBADIAH ELLIOTT'S *Safe Coach.*

Plate XXX is a view of the coach with one fore-wheel off, and only 8 inches out of level, showing the impossibility of an overturn.

Plate XXIX, fig. 1, is an elevated view of the coach;

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q, the body carrying four or six inside passengers, with an entrance door *b* at the back; *c*, the front boot for luggage; *d d*, the seat for ten or more passengers, connected to the body by a sliding rod *e*; *f*, a safe step; *g*, a private box in the foot board *h*; *i*, the hind luggage box or boot, with a groove or opening *k*, cased in the middle for the axletree to slide up and down in; *l*, a safe step; *m*, the iron straps which fasten the front boot to the elliptical springs; *n*, the iron strap securing the body and hind boot on the springs: the shackles *o o o o* are immoveably fixed to the ends of the bottom springs; the front springs are inclined two inches, and the hind ones one inch, their front ends being highest to counteract the concussion met with on the road.

Fig. 2 is a sectional view of fig. 1; *p q*, the seats inside; *c c*, the front boot, of ¾ inch board dovetailed and trussed together; *d d*, the front seat outside; *e*, the sliding rod, fastened to a wooden cross-piece *r* in the front boot, with iron bearings *s*, on the locking plate *t*; the rod passes through and revolves in three collars or bearings in the body *a*, and is secured with a nut and key at *v*; *h*, the front half of the hind luggage box opening at *u* from the inside of the body; *k*, the groove, up and down which the axletree plays; *i*, the other half of the luggage-box, with a door at *w* to open behind; the hanging step at *w* turns up to let the door open; *x*, seats behind for two or more passengers; *y*, a stay bolted on the cross piece *r*, and supporting the coachman's seat *z*.

Fig. 3 is a bird's-eye or ground view of fig. 1, showing the manner in which the front part locks round; *d d*, the front seat; *c*, a lift-up or trap door to the front part of the boot; *q q*, two angle doors (which can be made in one) to the hind part of the front boot; *r*, the cross piece to which the sliding rod *e e* is fastened: the iron bearings are shown by the dotted lines *s s*, and the locking plate by the dotted line from *t* to *t*, under the seat; *v*, the nut and key of the sliding rod under the seat rail in the body.

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Fig 4 is a view of the front seat rail of the body and the iron stay with a solid collar *v*, in which the revolving sliding rod is secured.

N° XXVIII.

SUN-DIAL.

The large SILVER MEDAL *of the Society was this Session voted to Mr.* GRIFFITH DAVIES, *teacher of the Mathematics, Cannon Street, London, for a* SUN-DIAL. *The following communication has been received from the candidate on the subject.*

43, Cannon Street,
December 8, 1819.

SIR;

I HAVE constructed a Sun-Dial of a peculiar description, and engraved it on a Welsh slate, 27 inches square and an inch thick.

If such should come within the object of the Society of Arts, &c., I shall feel happy in bringing it for their inspection at any time they may think proper to appoint.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. GRIFFITH DAVIES.

THIS dial, of which plate XXXI is a reduced drawing, by the shadow of one gnomon shows the following particulars, viz.

1. The hour of the day at London.
2. The hour of the day at Pekin.
3. The sun's place in the ecliptic, and the curves traced out, by the shadow of the summit of the gnomon, at the

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entrance of the sun into each of the 12 signs of the zodiac.

4. The day of the month.
5. The sun's declination.
6. The time of sun's rising.
7. The time of sun's setting.
8. The length of the day.
9. The Babylonish hour, or time from sun's rising.
10. The sun's altitude.
11. The sun's azimuth.
12. The equation of time to mean noon.
13. The day and hour when the sun is vertical at several places, situated between the tropics.
14. The proportional quantity of solar rays falling obliquely on a given surface, as compared with the quantity falling vertically on a like portion of surface.

As works on dialling contain directions for constructing sun-dials to show all these particulars, excepting the last three, the inventor submits his dial to the consideration of the Society, more on account of its novelty as a work of art, and the lowness of the price for which such dials may be engraved on slate as compared with brass, than for any peculiarity in the theory of its construction.

For the benefit of such as may be disposed to construct similar dials, the candidate has furnished the Society with the following sketch, which is partly an elucidation of the particulars before mentioned, and partly descriptive of the methods by which they were delineated.

The gnomon is made of solid brass, and is fixed to the slate by two legs, which are fastened underneath by screws. The dial is to be placed horizontally, so that the upper edge of the gnomon may be parallel to the earth's axis; and, for the sake of illustration, that side of the dial on which the shadow falls in the afternoon is denominated the right side, and the other the left.

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1. The hour of the day at London is shown by the shadow of the upper edge of the gnomon falling on the diverging lines, which are numbered on the interior circular line surrounding the gnomon, plate XXXI: the morning hours from 6 to 12 by the shadow of the *left* edge coinciding with the diverging lines, which issue from the point, and the afternoon hours from 12 to 6 by the shadow of the *right* edge coinciding with those diverging from the point. The hours before 6 in the morning and after 6 in the evening are shown by the shadows of the contrary sides of the gnomon on the continuation of the lines, which exhibit the hours respectively 12 hours distant from them.

Writers on dialling have demonstrated that the hour angles on the plane of a *horizontal* dial may be found by the following proportion, viz. radius : sine latitude : : tangent 15 n° : tangent of the angle made with the meridian line, by the line showing the nth hour from noon.

By this analogy the angles made by the hour lines on a horizontal dial in lat. 51° 32′ were found to be as follow:

Hour from Noon.	Angle.		Hour from Noon.	Angle.		Hour from Noon.	Angle.	
$\frac{1}{4}$	2°	56′	$2\frac{1}{4}$	27°	37′	$4\frac{1}{4}$	57°	48′
$\frac{1}{2}$	5	53	$2\frac{1}{2}$	31	0	$4\frac{1}{2}$	62	7
$\frac{3}{4}$	8	51	$2\frac{3}{4}$	34	29	$4\frac{3}{4}$	66	34
1	11	51	3	38	4	5	71	6
$1\frac{1}{4}$	14	53	$3\frac{1}{4}$	41	46	$5\frac{1}{4}$	75	45
$1\frac{1}{2}$	17	58	$3\frac{1}{2}$	45	35	$5\frac{1}{2}$	80	27
$1\frac{3}{4}$	21	7	$3\frac{3}{4}$	49	31	$5\frac{3}{4}$	85	13
2	24	20	4	53	36	6	90	0

In laying down these angles on the plane of a dial, it ought to be observed, that allowance must be made for the thickness of the gnomon, by measuring the angles for

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the afternoon hours from the right side of the gnomon, and the morning hours from the left.

2. The hour of the day at Pekin is shown in the same manner as the hour at London, by the shadow of one of the upper edges of the gnomon, and is marked on the exterior circle surrounding the gnomon. This line is laid down merely by converting the longitude of Pekin 116° 22′ into time = $7^h\ 45\frac{1}{2}'$, and placing each hour so much earlier than the same hour at London. In the same manner the time at any other place may be exhibited.

3. The sun's place in the ecliptic, or his entrance into the several signs of the zodiac, is shown by the shadow of the summit of the gnomon coinciding with the curves, which are drawn by strong lines across the dial from right to left; and the sun's place, when situated in any intermediate position, is marked on the lines, and discovered by the shadow in the same manner as the latitude of a place situated between two parallels on a map.

It is shown by writers on dialling that the curves traced out on a horizontal plane by the shadow of a fixed point, in any latitude below $66\frac{1}{2}$, are *hyperbolas;* and that the hyperbola thus traced on any day when the sun has a given north declination is equal, similar, and opposite to that described on the day when the sun has a like south declination. From this it follows that such curves may be thus described: let A B C, fig. 1, plate XXXII, represent the gnomon; A B E and *a b e* meridian lines, that is lines drawn parallel to and coinciding with the sides of the gnomon A B C; and let it be required to describe the hyperbolas traced out on the longest and shortest days. From the latitude 51° 32′ deduct the greatest declination 23° 28′, and there remains 28° 4′ for the sun's meridian zenith distance on the longest day; and by adding the greatest declination 23° 28′ to the latitude 51° 32′, we have 75° for the sun's meridian zenith distance on the shortest day,

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Again, by spherical trigonometry we have cosine lat. 51° 32′ : sine dec. 23° 28′ : : rad. : cosine of sun's azimuth at rising 50° 12′; hence by making the angle B C D equal to 28° 4′ and B C E = 75°, we have B D and B E for the respective lengths of the shadow of the perpendicular B C, on the meridian line A B E, on the longest and shortest days; and consequently D E for the transverse axis of the opposite hyperbolas traced out on those two days by the shadow of the point C. Bisect D E in O, and make the angle E O P = 50° 12′, the azimuth at rising; then will O P be an asymptote to the required hyperbolas. From E draw the perpendicular E P, meeting O P in P; and with the center O and distance O P describe a circle cutting the line A B E continued, in F and G; then, by conic sections, F and G will be the foci. Through F and G draw F *f* and G *g* at right angles to A B E, cutting the meridian line *a b e* in *f* and *g*. In E F produced take any number of points *r r r*, and with the distance E *r* and center F, describe an arc *m*; with the same distance and center *f* describe an arc *v* on the other side of E F; and from the points G and *g* as centers, still with the same distance, describe the arcs *n* and *x*; then with the distance D *r* and centers G and *g* intersect the arcs *m* and *v*; and with the centers F and *f*, still with the same distance, intersect the arcs *n* and *x*; proceed in the same manner to find any number of points *m m m*, *v v v*, *n n n*, *x x x*, &c.; then a curve drawn through the points *m m m*, *v v v*, and another drawn through *n n n*, *x x x*, will be the hyperbolas required. This is the *principle* upon which all the lines exhibiting the sun's place on the dial are delineated; but the *method* by which they have been actually described was rendered less complicated by the construction of the following table;

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Sun's Place.		Sun's corresponding Declination.	Meridian Zenith Distance.	Natural Tang. of Zenith Distance.	Sun's Azimuth at rising.	Semitransverse Axis of Hyperbolas.	Distance from Center to each Focus.	Distance from Base of Gnomon to Foci.	
								Nearest.	Farthest.
♋	30°	23° 28′	28° 4′	.5332	50° 12′	1.5994	2.499	.3664	4.6316
10°	20	23 5	28 27	.5418	50 56	1.5466	2.454	.3656	4.5424
20	10	21 58	29 34	.5673	53 2	1.4043	2.335	.3634	4.3066
♌	♊	20 10	31 22	.6096	56 21	1.2072	2.179	.3622	3.9958
10	20	17 45	33 47	.6690	60 39	.9875	2.015	.3585	3.6715
20	10	14 48	36 44	.7463	65 45	.7678	1.869	.3549	3.3831
♍	♉	11 29	40 3	.8406	71 20	.5617	1.755	.3527	3.1573
10	20	7 48	43 44	.9567	77 24	.3646	1.671	.3497	2.9223
20	10	3 55	47 37	1.096	83 42	.1782	1.622	.3478	2.8962
♎	♈	0 0	51 32	1.258	90 0	0	0		
10	20	3 55	55 27	1,452					
20	10	7 48	59 20	1.686					
♏	♓	11 29	63 4	1.964					
10	20	14 48	66 20	2.282					
20	10	17 45	69 17	2.644					
♐	♒	20 10	71 42	3.024					
10	20	21 58	73 36	3.376					
20	10	23 5	74 37	3.635					
30	♑	23 28	75 0	3.732					

The second column of this Table, marked sun's corresponding declination, is laid down from a diary for the second year after a leap year. The third column is formed with the latitude and declination as before directed. The numbers in the fourth column are the natural tangents, to radius unity, of the corresponding degrees and minutes in the third column; and if those numbers were multiplied by B C, fig. 1, the perpendicular height of the gnomon, the results would represent the distance of the meridian shadow of the point C, from B the base of the gnomon, on those days corresponding to the sun's place in the ecliptic, as marked in column 1. The fifth column, marked sun's azimuth at rising, is formed as before directed. The sixth column is formed from the fourth; thus $\frac{BE-BD}{2}=\frac{DE}{2}=OD$ or OF, that is $\frac{3.732-.5332}{2}=\frac{3.1988}{2}=1.5994$ $=\frac{3.635-.5418}{2}=\frac{3.0932}{2}=1.5466$, and so on. The

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seventh column is formed from the fifth and sixth, thus, cosine of E O P 50° 12′ : O E 1.5994 : : radius : O P = O F or O G 2.499; cosine 50° 56′ : 1.5466 : : rad. : 2.454, and so on. Lastly, the 8th and 9th columns are formed from the 4th, 6th, and 7th; thus, O G — (O D + B D) = B G, and O F + O D + B D = B F, that is 2.499 − (1.5994 + .5332) = 2.499 − 2.1326 = .3664; and 2.499 + 2.1326 = 4.6316 : 2.454 − (1.5466 + .5418) = .3656 and 2.454 + 1.5466 + .5418 = 4.5424, and so on. The construction of the lines on the dial exhibiting the sun's place, by the assistance of the above Table, is as follows: .5332 multiplied by the height of the gnomon, and the result laid off from B and *b*, will give the points D and *d*, and 3.732, multiplied by the said height, and the result laid off from B and *b* will give the points E and *e* in the opposite hyperbola. Also .3664 and 4.6316 multiplied by the height of the gnomon, and the results laid off in contrary directions from B and *b*, determine the foci G *g* and F *f*, whence the hyperbolas *n x* and *m v* may be described as before directed. In the same manner the hyperbolas traced out by the summit of the gnomon on any two days, when the sun has equal and contrary declination, may be delineated. Note—when the sun is on the equator, the opposite hyperbolas coincide and degenerate into a straight line.

Conceiving the accuracy of the lines exhibiting the sun's place, to be of importance for determining the positions of several lines exhibiting other particulars, I have adopted a method of verifying this construction, by calculating the sun's altitude at different hours from noon, on the several days when the sun's place in the ecliptic is such as is marked in column 1 of the preceding Table. And having found the sun's altitude for any given day and hour, the sun's zenith distance at that time is found by

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subtracting the altitude from 90: Then by multiplying the tangent of the zenith distance by the height of the gnomon, and taking the result for a radius, with the base of gnomon as center, and drawing a circle to intersect that hour line, a point in the hyperbola will be obtained. Thus, let the one o'clock hour line A Q be produced indefinitely to K; find the sun's altitude on the longest day at one o'clock, and subtract it from 90°; take the natural tangent of the remainder, and multiply it by the height of the gnomon B C; then with the result as a radius, and with the center B, intersect A K in Q; then shall Q be a point in the hyperbola *x x n n:* in the same manner the point T in the hyperbola *v v m m* may be found.

4, 5, 6, 7, 8, the lines exhibiting the day of the month, sun's declination, time of sun's rising, time of sun's setting, and length of the day, were laid on the dial, by the assistance of an ephemeris, opposite their corresponding degrees of the sun's place in the ecliptic; and as these particulars are shown by the summit of the gnomon in the manner before described of the sun's place, they require no further explanation.

9. The Babylonians considered their day to begin at sun-rising, and to end at the following sun-rising, and they conceived it divided into 24 equal parts. Hence it is manifest that neither their days, nor the parts into which they were divided, were exactly equal; but so far as regards dialling, the difference is so small, that all their days may be considered as equal, and each of the parts into which they divided them may be looked upon, in point of duration, as equal to *one hour;* and in this light the "*Babylonish hour*" becomes synonymous with the "*time from sun's rising.*" Writers on spherics (of whom Theodosius is one) have demonstrated that the sun, at a given interval after rising, is on the circumference of the same

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great circle all the year round; while those on dialling, or on the projection of the sphere, have proved that in the gnomical projection, all great circles are projected into straight lines. Moreover, supposing the earth a perfect sphere, and abstracting from the effects of refraction, it is evident that the sun, when on the equator, must rise at 6 o'clock.

Again, by spherics, rad. : tang. lat. 51° 32′ : : tang. declination 23° 28′: sine ascensional difference 33° 7′, and 33° 7′ ÷ 15 = 2ʰ 12½′; then 6ʰ − (2ʰ 12½′) = 3ʰ 47½′ for the time the sun rises at London on the longest day; and 6ʰ + (2ʰ 12½′) = 8ʰ 12½′ for the time of rising on the shortest day. From these principles the Babylonish hour may be laid on a dial, in the following manner: for example; let it be required to lay down the fifth Babylonish hour:

3ʰ 47½′ + 5ʰ = 8ʰ 47½′ A.M. 6ʰ + 5ʰ = 11ʰ A.M. and 8ʰ 12½′ + 5ʰ = 13ʰ 12½′ A.M. or 1ʰ 12½′ P.M.

Whence, by the method of drawing the hour lines already described from the point *a*, draw the line *a h* to exhibit the time 8ʰ 47½′ A.M., cutting *x n* in *h*, and through A draw A *z*, to show the time 1ʰ 12½′ P.M., cutting *v m* in *z*; join B *z* and *b h*; make B *y* equal and parallel to *b h*, and *b m* equal and parallel to B *z*; join *h m* and *y z*; then shall the shadow of the point *c*, at 5 hours after sun's rising, all the year round, touch the line *h m*, while that of the point C touches the line *y z*; and *h m*, *y z* or *h i* I *z* will be the line required. The position of the line *h m* may be verified by drawing the equator S W, intersecting *h m* in U, and joining all; then if all coincide with the hour-line of 11 A.M., this affords a proof that *h m* is correctly laid down. In a similar manner all the other Babylonish hours may be drawn and verified. In my dial the shadow of the point *c*

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only is made use of to show all the Babylonish hours; but it would be more analogous to the other lines to make use of the shadow of the point *c* on those parts of the lines which fall to the left of the meridian line, and that of the point C on the parts which fall to the right of that line; in that case such of the Babylonish hour-lines as cross the meridian line, must be of the form of *h i* I *z*.

10. The almacanters, or parallels of the sun's altitude were drawn by multiplying their natural cotangents by the height of the gnomon, and describing circles with the results as radii, and the foot of the gnomon as center. Thus the cotangent of 20° = 2.7475, multiplied by the height of the gnomon B C, and with the result as a radius and the point B as a center, describe an arc L M, and with the same radius and center *b*, describe a similar arc N Y; then when the sun's altitude is 20°, the shadow of the point C in the afternoon shall touch the arc L M, or in the forenoon the shadow of the point *c* shall touch the arc N Y.

11. The azimuth lines were drawn by describing a semicircle 4, 5, 6, about the point B, and another about the point *b*, dividing each of them into 16 equal parts, and through the points of division drawing straight lines, diverging from the points B and *b*. Thus, if the arc 4, 5, = 4 sixteenths of the semicircle 4, 5, 6, and through the points B. 5 a straight line 1, 5, 2, be drawn, the shadow of the point C will touch it when the sun's azimuth is S. SW.

12. Equation of time to mean noon.

Since each degree on the equator answers to 4 minutes of time, it follows that *n* minutes of time answers to $\frac{n}{4}$ degrees on the equator. Hence rad. : sine lat. : : tang. $4\,n^{\circ}$: tang. of the angle which the hour line of *n* minutes

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makes with the meridian line. By this proportion the following table was constructed:

Time.	Natural Tangents.	Time.	Natural Tangents.	Time.	Natural Tangents.	Time.	Natural Tangents.
1′	.00342	5′	.01708	9′	.03076	13′	.04446
2	.00683	6	.02050	10	.03419	14	.04789
3	.01025	7	.02392	11	.03761	15	.05132
4	.01367	8	.02734	12	.04103	16	.05475

Again, by means of an ephemeris we find that when the mean noon falls 2 minutes later than apparent noon, the sun's declination is 23° 22′ S.; when 4 minutes the declination is 23° 10′; when 6 minutes, 22° 50′ &c. Whence 51° 32′ + 23° 22′ = 74° 54′, the sun's zenith distance, when the mean noon falls 2 minutes later than the apparent noon; in like manner 51° 32′ + 23° 10′ = 74° 42′, 51° 32′ + 22° 50′ = 74° 22′ &c.

Whence take any distance A D, fig. 2, plate XXXII, on the meridian line, and multiply the natural tangents in the above table severally by that distance; then lay off the results from D, on this perpendicular line D E, and from A, through the several divisions of D E, draw straight lines A 2, A 4, A 6, &c.

Again, multiply the natural tangents of 74° 54′, 74° 42′, 74° 22′, &c., by the height of the gnomon B C, and lay off the results from B towards D, which will give the points *d e f*, &c.; then through *d* draw a curve (as described in speaking of the lines exhibiting the sun's place), cutting A 2 in *a*; in like manner draw similar curves through *e f*, &c., respectively cutting A 4, A 6, &c., in *b c*, &c. Lastly, through the several points *a b c*, &c. draw a curve, which, by the shadow of the summit of the gnomon will show the mean noon; and since the apparent noon is shown by the shadow of the gnomon coinciding

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with the meridian line; it follows that the difference or interval between them must show the equation of time to mean noon.

13. The method of exhibiting on the dial the day and hour when the sun is vertical at any place situated within a certain limit: I shall take as an example the Island of St. Helena.

By means of the latitude of London 51° 32′ N., and the latitude and longitude of St. Helena 15° 55′ S. and 5° 49′ W., the distance of St. Helena from London is (by spherical trigonometry—see Bonnycastle's Trig. case 8th oblique spherics), found to be 67° 39′; whence it is manifest that when the sun is vertical at St. Helena, it must be 67° 39′ from the zenith of London; and since the zenith distance and the altitude must together make 90°, it follows that 90°—67° 39′ = 22° 21′ = the sun's altitude at London at the time when it is vertical at St. Helena. Again, because the longitude of St. Helena is 5° 49′ West from London, and 4 minutes of time corresponds to each degree of longitude, it is manifest that when the sun is vertical at St. Helena, it must be 23¼ minutes past 12 o'clock at noon at London.

From what has been said, the following construction naturally arises: multiply the natural cotangent of 22° 21′ by the height of the gnomon, and with the result as a radius, and B as a center, describe an arc G H, fig. 2; then draw the hour line of 23¼ minutes P. M. intersecting G H in S, and the point S will be that on which the shadow of the summit of the gnomon will fall at the time when the sun is vertical at St. Helena. In the same manner may be shown the day and hour when the sun is vertical at any other place situated between the tropics, provided its distance from London be less than 90°.

14. The last particular enumerated on my dial, is the proportional density of the solar rays at London,

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as compared with that of vertical rays. For the sake of elucidating this particular, let it be granted, 1st, that a small portion of the earth's surface may be considered as a plane; 2ndly, that all the solar rays which fall upon such surface may be considered as parallel to each other; and 3rdly, that the density of the solar rays may be considered as not in the least affected by the comparatively small difference in the distance of one part of the earth's surface from the sun, and that of another part.

Next, conceive a square portion of the earth's surface, situated at right angles to the solar rays, to be divided into 10 equal parts by straight lines drawn parallel to one of its sides, and let the aggregate quantity of solar rays falling upon each of those parts, be called a single ray. Then, conceive the straight line C P, fig. 3, to represent one of the divided sides of such a square, and the perpendiculars C Q, 11, 22, &c., to represent the divisions of the rays which fall upon it. Moreover, conceive the square to be moved about one of its undivided sides as an axis, then will one of the extremities P, of the divided side C P, describe the circular arc P Q.

From this view of the subject, it is evident that if the position of the rays remain invariable, the number of rays falling on the given square at the position C 9 will be only 9, at the position C 8, only 8, &c., and at the position C Q not a single ray will fall upon it. Since, therefore, at the position C 9, 9 rays are distributed over the same portion of surface as the 10 rays at the position C P, it follows that the density of the solar rays on the given surface, placed in the position C 9 will be only $\frac{9}{10}$, and in the portion C 8 only $\frac{8}{10}$ of that in the position C P.

Again, it is equally evident that the density of the rays on the given plane will be affected exactly in the same manner, whether we conceive the position of the rays to remain invariable, and the plane to be moved, or the plane

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to remain fixed, and the direction of the rays to be changed, provided the obliquity of the rays to the plane be the same in both cases.

From what has been said, the following construction is manifest: upon C B, fig. 2, construct the quadrant B C R, and from C draw C K, C L, C 3, C 4, &c., making the angles R C K, R C L, R C 3, R C 4, &c., respectively, equal to the angle Q C 1, Q C 2, Q C 3, Q C 4, fig. 2, &c.; then will the point 3, on the line A D fig. 2, be that on which the shadow the summit of the gnomon falls at the time when the density of our meridian solar rays is to that of vertical rays, as 3 to 10; the same may be said of the points 4, 5, 6, &c. By making B F equal to the length of our meridian shadow on the shortest day, and B V equal to that on the longest day; and joining C F, C V, it will be found that the density of our meridian rays varies at different seasons of the year, from about 2¼ tenths to pretty nearly 9 tenths.

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N° XXIX.

APPARATUS FOR SAVING LIVES IN CASE OF SHIPWRECK.

The large SILVER MEDAL *and* THIRTY GUINEAS *were this Session voted to Mr.* H. TRENGROUSE, *of Helston, near Truro, for his* APPARATUS FOR SAVING LIVES IN CASE OF SHIPWRECK. *The following communication has been received from the candidate on the subject, and a Model of his Apparatus has been placed in the Society's Repository.*

SIR;

I BEG through you to offer to the notice of the Society of Arts my Apparatus for preserving Lives and Property in cases of Shipwreck, together with a short printed essay on the subject. It is my wish that experiments should be tried with the apparatus in any way that the Society may think fit for their entire satisfaction; in the performance of which I shall most gladly contribute my best assistance.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. HEN. TRENGROUSE.

Of the multitudes of seamen and others who perish yearly by shipwreck, a considerable proportion are lost,

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in consequence of ships getting on shore, either by the violence of the wind or by other accidents. In these disastrous circumstances the severity of their fate is aggravated with regard both to the sufferers themselves and the spectators, by the smallness of the interval interposed between security and destruction, and the seeming ease of effecting a communication between the stranded ship and the shore. Many inventions have already been proposed for this purpose; but having been brought into practice either very partially, or not at all, have failed of producing the benefits anticipated by the too sanguine benevolence of their authors.

Captain Manby's apparatus, although resembling Mr. Trengrouse's in some particulars, is both less portable and less likely to succeed in actual practice. The *initial* velocity of a ball or shell is so great as to make it by no means easy, under the most favourable circumstances, to supply the cord attached to the ball with sufficient expedition: whereas, the flight of a rocket being not only much slower on the whole than that of a cannon ball, but not immediately acquiring its utmost velocity, the risk of breaking the cord is greatly diminished.

From experiments made at Woolwich before lieutenant-general Ramsey and a board of officers, in conjunction with rear-admiral sir C. Rowley and two captains in the royal navy, it appears that a rocket of 8 oz. with a mackerel line attached to its stick ranged to the distance of 180 yards, and that a pound rocket in similar circumstances ranged 212 yards. Experiments made for the same purpose by the Society of Arts, demonstrated that a rocket 1¾ inch in diameter will carry a cord completely across the Serpentine river in Hyde Park. Now the shortest of these ranges exceeds the distance of many stranded ships from the shore, especially on a rocky coast, and therefore ascertains the probable utility of Mr.

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Trengrouse's apparatus on a multitude of occasions, particularly within the limits of the British Channel, the great thoroughfare for shipping of every description.

Explanation of the Engravings of Mr. TRENGROUSE'S *Apparatus*, Plate XXXIII.

Fig. 1 represents a chest containing the whole of the apparatus with which it is proposed every vessel should be furnished; its internal dimensions are 4 feet 3 inches, by 1 foot 6 inches, and 1 foot 8 inches deep. The lid forms a case for containing eight or twelve half-pound rockets, laid alternately the heads each way; to accommodate which, the two lids which cover them are deeper at their outer extremities, and are secured by thumb screws; one of these is shown open. The body of the chest is divided as described at fig 7. N° 1 contains a musket to be used merely for directing and igniting the rocket. The gun being charged with a small quantity of powder without wadding, a copper instrument, shown fig. 2, is attached to the barrel by a bayonet catch, for the purpose of receiving the head of the rocket, the stick lying along the top of the barrel, and having secured to it one end of a coil of small line deposited in the compartment N° 2 of the chest. The explosion of the powder having only the effect of lighting the rocket, it burns for a few seconds before it requires sufficient momentum to quit its situation, during which time the combustible matter would be ejected into the barrel of the gun, but for the following contrivance: at the junction *a*, fig. 2, of the large and small portions of the copper instrument, a valve is loosely hung on a joint, which opens to permit the passage of the charge, but immediately closes, and pre-

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vents the barrel being choked by the discharge from the rocket. The small line being thus conveyed to the shore, one end of a small cord (vide fig. 1, and N° 3, fig. 7) is fastened to it, which the persons on the rock or beach will haul to them, and which will in similar manner convey a hawser, secured at one end to the mast, and at the other to any convenient object. The communication now being effected, a small light chair, fig. 4, and a life spencer, fig. 6, which occupy the space N° 4 in the chest, are to be taken out, and the former attached to the hawser by two rollers, one of which is seen on a larger scale in fig. 5. For more conveniently applying these rollers, the hook which is in two parts, on withdrawing the screw *b*, opens on the joint *d*; it may then be put over the hawser, and the chair attached, the small bar *e*, turning on a joint *e*, preventing the chair from being disengaged: the whole is then clamped together by the screw *b*. The small cord *f*, fig. 4, which is used for drawing the chair to and from the shore, is the same which is used for hauling the hawser; it is of course requisite that the length of this cord should be at least twice as much as the distance from the vessel to the shore. Previous to placing a person in the chair, it is proposed that he should put on the cork spencer, fig. 6, formed of ribs of cork sewed in a canvas case, and fastened by a strap and buckle, to prevent him from being immersed in the waves from the swagging of the hawser, or wounded by floating pieces of wreck. The spencer is to be returned to the vessel with the chair. Fig. 3 is a piece of wood 12 inches long, and at the larger end 2 inches in diameter, for the purpose of winding the balls of line thrown by the rocket; the small end to be held in the hand while the line is wound round the other.

The case in which are the two balls of small line slides up, and beneath are deposited two balls of line rather stronger, to accommodate rockets of different sizes, which

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must be used according to the distance from the shore. The two cases 5 and 6 also slide up, and discover a waterproof canvas bag, in which papers of any kind may be secured and committed to the waves.

In N° 5 is a ball of hard wood, about four inches diameter, one half painted black and the other white, attached to a few fathoms of small line, to enable persons in a boat (throwing the ball by hand), to form a communication with individuals at a short distance, or on a rock.

In N° 6 are placed a powder-flask, flints, gun-worm, picker, a bottle of fine oil, &c.

N° XXX.

DETACHED CLOCK ESCAPEMENT.

The large GOLD MEDAL *and* FIFTY GUINEAS *were this Session voted to Mr.* WM. HARDY, *of Wood Street, Cold-bath Fields, for a* DETACHED CLOCK ESCAPEMENT. *The following communication has been received from the candidate on the subject, and a Model of his Invention is placed in the Society's Repository.*

5, Wood Street, Coppice Row, Cold-bath Square,
April 25, 1820.

SIR;

I HEREWITH send you a drawing and description of a new Escapement for a Clock, and beg you will lay it before the Society for the Encouragement of Arts, &c. Before I describe the principle on which it is constructed, allow me to mention one circumstance which I think deserves to be taken notice of. This escapement, in the

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first instance, was applied to a clock which had been going with the common dead beat pallets. Having ascertained the arc of vibration of the old escapement, I removed it, and applied the new one; and having adjusted the force of the two springs (which give the impulse to the pendulum), to that of the maintaining power before applied, I set the clock a going, when I soon found the pendulum to have increased on its arc, from 4 to nearly 7 degrees. I then reduced my pallet springs to nearly one-half their strength; and yet with all this reduction of power in the springs, the pendulum still vibrated as far as it did with the old escapement when the whole of the maintaining power was applied. By this experiment is shown the great influence which the resistance of the dead beat pallets and crutch pivots have on the pendulum; and also proves that nearly one-half of the maintaining power is lost on the clock from this cause. The result of this experiment gave me great hopes of success. I therefore prepared the clock with a mercurial pendulum, in order to make trial of it at the Royal Observatory; and having written to the Board of Longitude on the subject, they referred the matter to the late Rev. Dr. Maskelyne, who very readily undertook the trouble of giving it a thorough trial. He accordingly called on me the day after the meeting of the Board, to see the escapement; and being pleased with it, desired me to send the clock to the Observatory for trial, as soon as I possibly could. It was from the satisfactory performance of this clock, that I was recommended by the Doctor to the Board of Ordnance as a fit person to furnish a clock on the same principle for the room in which the famous mural circle is placed, which circle was then making by the celebrated Edward Troughton. The order for the clock was unlimited in price, and directed me to consult the Doctor on every particular connected with it. I therefore waited on

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the Doctor to receive his instructions; his treatment to me was kind and hospitable, and he gave me every encouragement to exert myself, and to complete the clock in such a manner as to be durable and certain in its performance. As it was to accompany one of the most excellent instruments that ever was made, he wished the clock to be equally so in point of excellence. This excited me to use my utmost exertion, and to spare neither time nor expense in order to make it as perfect as possible. It was decided upon to jewel every action in the escapement and all the pivot holes. The teeth of the wheels and pinions were epicycloidal, and were all finished in the engine by cutters which I made for that purpose; and the whole of the clock was finished in a style equal to any of our first-rate chronometers. The Doctor being sensible of the great importance of fixing up the clock upon a material that should be permanent and immoveable, I suggested that it should rest upon a strong brass plate screwed fast to the top of a stone pier, in which a recess or channel might be cut out to receive the weight and the pendulum, which was adopted. I cannot here refrain from saying a few words to the memory of the late Rev. Dr. Maskelyne. My first knowledge of the Doctor was at the period above mentioned; at that time they were making great improvements at the Observatory, which engrossed the whole of the Doctor's attention; the room for the new instruments was then building, and such was his perseverance, that he was out there in the most inclement weather, superintending the workmen, which I believe tended much to shorten his days: he was most indefatigable in his application to the interest of the Observatory, no doubt, for the great end of advancing the science of astronomy, in which he delighted. His attention to the business of the Observatory was punctual and strict, and he continued to transact it till within a week or two of his death, an event which, it

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will be allowed, was a great loss to the public, and to be regretted the more as he did not live to see the new instruments completed, in which he took such pride, and which he strove so much to accomplish.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. WM. HARDY.

Reference to the Drawings of MR. HARDY'S *improved Clock Escapement, as applied to a Regulator.*

Plate XXXIV is a view of the back part of the clock without its case, having the middle part of the back plate removed, as represented by the two fractures, to show the train of wheels; the lower part of the pendulum rod being also removed, as is shown by the fracture: the pendulum is represented as when at rest.

Plate XXXV is a side view of the clock from the left-hand side of the plate XXXIV, having the back plate complete, and the pendulum rod as far as the limits of the engraving will permit.

Plate XXXVI shows a detail of the various parts of the escapement, together with a front view of the dial-plate, &c., and the manner of suspending the weight.

All the parts of the clock are drawn to the full size, except plate XXXVI, figs. 16 and 17, which are to $\frac{1}{4}$, and fig. 18 to $\frac{5}{2}$ the whole size.

The same letters and figures refer to the same parts in the plates XXXIV, XXXV, and XXXVI.

A A, plate XXXV, represents the edge of a horizontal brass plate, which must be fixed on two brackets firmly screwed to a stone pedestal or wall, and quite independent of any part of the case of the clock. In the back part of

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this plate is a slit for the motion of the pendulum, and also one for the cord to pass through, which suspends the weight, and this cord I recommend to be of silk. On the upper side of the plate A A are fixed the two frame-plates B and C of the clock, by means of the four brackets D D, &c., which are fixed to the frame plates by the screws E E, &c., and to the plate A by the screws F F, &c. The frame plates B and C are kept parallel to each other by four pillars G G, &c., and are secured by the six screws H H, &c., and the two screws E E. The dial plate is kept parallel to the front plate B, by means of the four pillars J J, &c.; one end of each is screwed into the plate B, and the other end passes through the dial plate I, and is secured by the four screws K K, &c. To the upper end of the frame plates B and C is fixed (by the two screws M M) the cross or suspension bar L L, which carries the pendulum. N is the barrel on which the cord is wound that suspends the weight, and is supported by its axis in the frame plates B and C; the end of the axis which comes through the plate B also passes nearly through the dial plate, and has a square end, which fits the key for winding up the weight. P is a spring which is fixed on the outer end of the barrel, to the side of the spring next the barrel, and near one end of it is attached a stud Q, equal to the diameter of the cord, which passes freely through the end of the barrel. The upper side of the stud is bevelled off so as to form an inclined plane with the upper side of the barrel. On the other side of the spring, opposite the stud Q, is formed a catch, which lays hold of the stop R (and which is fixed to the frame plate B), when the spring is thrown out. When the barrel is filled with cord, the last coil will act against the inclined end of the stud Q, and throw out the spring P, so as to catch the stop R, and prevent the cord from being over-wound. On the other end of the barrel

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is fixed a catch wheel S (plate XXXIV); and before the wheel S, on the axis of the barrel, is fitted the catch wheel T, the middle part of which forms a flat plate to which the arms and rim are attached; on the back part of the plate are fixed the two catches U U (pl. XXXIV), which act in the catch wheel S and prevent the weight from running down without turning the wheels T V and X. On the end of the axis of the barrel is also fitted the wheel V close to the wheel T: on the outside of the plate of the wheel T are fixed two springs Y Y which act against two of the arms of the wheel V, and tend to keep it in motion and in the same direction as when the weight turns the barrel. This spring only acts at the time when the barrel is in the act of winding up the weight, so that no time will be lost; Z is a catch which acts on the upper side of the catch wheel T, and prevents the wheel T from being turned in the direction of the barrel when the barrel is in the act of being wound up. The wheel X is fixed to the arms of the wheel V by three screws, and acts in the wheel *a*, the axis of which carries the hour-hand; the wheel V acts in the pinion *b*, which is fixed on the axis of the wheel *c*; the axis of the wheel *c* carries the minute hand; the wheel *c* acts in the pinion *d* on the axis of which is fixed the wheel *e*; the wheel *e* acts in the pinion *f* on the axis of which is fixed the escape wheel *g*; this axis also carries the seconds hand. One end of the axis is supported in a jewelled hole in the cock *h h*, and the other end is supported and passes through a jewelled hole in the frame plate B. The pivots of the axis of the wheel *e* and pinion *d*, are rounded a little at their ends, and touch or bear against two cocks 20 20, which are secured to the frame plates B and C by screws and steady pins, thus rendering shoulders unnecessary, and, consequently lessening the friction thereof: the holes in the frame plates for these pivots are also considerably

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widened inside, so that the oil naturally flies to the ends of the pivots, and constantly lubricates them, the cocks being purposely filed away, clear of the plates B and C. A similar precaution is likewise taken with the back pivots of the great wheel V, and the center wheel *c*.

My attention had long been directed to the principles on which the various watch and clock escapements have been constructed, when I undertook, by way of experiment, to vary several of the constructions in such way as I thought might best answer their respective purposes; and of the numerous plans that suggested themselves to me for an improved clock escapement, I selected the one which forms the subject of this communication, as most likely to succeed; fortunately I have not been disappointed in this expectation. The figures contained in plates XXXIV, XXXV, and XXXVI, will explain the principle, the construction, and also the action of the escapement, which I beg leave to describe for the consideration of the Society, to which I am already indebted for several premiums; and as this escapement has undergone a most satisfactory trial, not only at Greenwich, but in other public and private observatories, I feel a certain degree of confidence that its claim to public attention will be considered as well founded.

The upper ends of plates XXXIV and XXXV show the entire escapement with all its parts in their proper places in connection with the train. The construction of the several parts of the escapement will be better understood by referring to plate XXXVI. Fig. 1 represents a back view of the escapement wheel, together with its cock and appendages, and the two spring detents *i* and *j*: the wheel is represented as locked by the detent *i*; *k k* are two small cocks fixed on the upper side of the cock *h h*, having an adjusting or banking screw *l* in the upper end of each, which acts against the underside of the spring

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detents *i* and *j*, and prevents the detents from locking too deep in the escape wheel.

Fig. 2 is a view of the upper side of the cock *h h*, without the two small cocks *k k*.

Figs. 3 and 4 are side views of the spring detents *i* and *j*.

Fig. 5 represents a back view of the escapement wheel, and the two spring pallets *m* and *n*, having the two arms of the spring detent removed; but the locking parts *i* and *j* are shown in section in their proper places, when the wheel is locked by the detent *i*; on the upper part of the detent *i* and on the under part of the detent *j*, are fixed two jewels, which act against the face of the teeth.

It may be observed here, that the faces of the teeth above and below are at equal distances from the under side or jewelled part of the detent *j*, consequently the drop or motion of the wheel will be equal to one-half of the space between any two of the teeth, when the wheel is unlocked by each vibration of the pendulum. When the wheel is locked by the detent *i*, the end of the tooth *o* will have slid along the face of the pallet *m*, and have raised it to its greatest extent, and the end of the tooth *p* will be ready to act on the face of the pallet *n*.

Figs. 6 and 7 are side views of the two spring pallets *m* and *n*: *q*, figs. 8 and 9, are a back and an edge view of an adjusting plate, which must be fixed to the back part of the frame plate *c*, under the bar L. Fig. 10 is a back and fig. 11 a side view of the triangular cock *r*, to which the two spring detents and the two spring pallets are fixed by the four screws *s s s s*, and the strengths of the springs are adjusted by the four screws *t t t t*, which screw into the upper ends of the spring detents and pallets, and act against the cock *r*: this cock is fixed to the plate *q* by the screw *u* (plates XXXIV and XXXV), which passes through the slit in the lower part of the cock, and screws into the plate *q*. On the back part of the cock *r* is fixed a

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stud *v*, which passes through the slit in the upper end of the plate *q*, by which means the cock *r*, together with its appendages, may be adjusted so as to make the drop or motion of the wheel equal, during each vibration of the pendulum.

Fig. 12 exhibits a back view of the upper portion of the pendulum, with a cross bar *w w*, attached at right angles to it, which is used for the double purpose of receiving the impulse of the maintaining power, and of unlocking the detents. Fig. 13 is a view of the upper side of the cross bar *w w*, and a section of the pendulum rod opposite to it. The two ends of the bar which receive and give the impulse to the two spring detents and the two spring pallets are projected forward so as to be in a line with the center of gravity in the pendulum.

Fig. 14 is a side view of the upper part of the pendulum, without the cross bar *w w*.

Fig. 15 is a side or end view of the cross bar *w w*; *x x*, fig. 14, is the upper part of the pendulum rod, having a notch or recess in the back part of it to receive the cross bar *w*, which bar *w* has a slit opposite the center of the pendulum to admit of the bar being slid to the right or left, and through which the screw *y* passes and screws into the pendulum rod fixing the bar in the situation required: *z* is a piece of spring plate, which connects the pendulum rod to the suspension piece 1, which is fixed in a slit in the end of the cross or suspension bar L L, by the screw 2 (plates XXXIV and XXXV.) Fig. 16 represents a front view of the dial plate, and the manner of suspending the weight. The lower circle 3 is divided into 24 hours, the great or outer circle into 60 minutes, and the upper circle 4 into 60 seconds; so that the time will be exhibited by their respective indices or hands at the same instant. The dotted circle N represents the end of the barrel; 5 5 is the cord, one end of which is fixed to the

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under side of the plate A A, the other passing under the pulley 6 (which works in a recess in the upper end of the weight o), through the plate A, is fixed to the barrel N, by which means the weight will be raised to a greater altitude than if the pulley had been fixed above the weight.

Fig. 17 is a view of the upper side of the weight *o*.

Fig. 18 represents an end view of the barrel N, and the spring P which prevents the cord from being over-wound as before described.

It will probably appear, on a superficial view of these figures, that my escapement greatly resembles some others that have been previously contrived, such as those by Mr. Cumming, Mr. Massey, and Mr. Prior, some of which have been rewarded by this Society; but the detail which I have to offer in explanation of the properties of mine, will prove that its mode of action is very different, and as I think, very superior; which is my reason for laying it before the Society.

This escapement is one of that species which has been called *remontoir*, because a spring is raised or put into a state of tension by means of the train, at each vibration of the pendulum, which spring, in its return, gives the necessary impulse for perpetuating the vibrations in spite of friction and other obstacles, and therefore becomes the *maintaining power*, while the weight that actuates the train, performs no other office than putting that spring into a state of tension.

In a clock escapement, where the pendulum is the regulator, the alternate vibrations made in opposite directions require two such springs to act by turns, and in such a modified way as to produce their desired effect with the fewest disadvantages. In the figures of all the different plates, the two interior springs marked *i* and *j*, are called the spring detents, because they detain the wheel during some portion of each vibration, and the two exterior ones

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m and *n*, are called the spring pallets, because they carry each a separate pallet, by means of which the springs themselves are raised into a state of tension, as often as a tooth of the pallet wheel *g* slides along them respectively. The wheel with a seconds pendulum has, as usual, 30 teeth, standing with a small inclination, as represented in the figures, and the direction of motion is indicated by the said inclination. At *r*, fig. 10, is a triangular cock, fixed to the frame in such way that its lowest angular point is in the same horizontal line with the point of suspension of the pendulum; and to the two sides of this triangular cock are made fast the two pair of springs, by means of four screws, as seen clearly in the figures; and as the springs all yield at the said triangular point, it is evident that when any of the four springs moves, it must move concentrically with the moving pendulum, which is fixed to the suspension piece 1. On the upper side of the arm of the spring detent *i* and *j*, is formed a projecting boss, through which a cylindrical hole is made, to receive one end of the locking pins or detents *i* and *j*, which are jewelled and fixed by the screws 7 7, the faces of the jewels being previously adjusted for catching a tooth of the escape wheel. At the lower extremities of the two spring detents *i* and *j*, and the two spring pallets *m* and *n*, are fixed fast four long brass pins 8, 9, 10, and 11, all of which, both side-ways and in front, are clearly seen: these pins project out past the end of the cross bar *w* of the pendulum, in a direction parallel to the arbor of the escape wheel; and when the pendulum *x x* is in its place vibrating, the ends of the cross bar *w w*, carried by the pendulum, meet with and knock against each pair of pins alternately, and are in succession in a situation to be re-acted on after each vibration is completed: the ends of the cross bar *w w* are bevelled, so as to form a radial line from a center in the upper part of the spring *z*, which is opposite a hole 12

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in the spring: this hole, made for the purpose of reducing the strength of the spring opposite to it, will be the center of vibration of the pendulum: a small hole 13 13 is likewise made in each of the two spring detents, and two small holes 14 14 in each of the two spring pallets, which will also reduce the strength of the springs opposite to each of them, and which will be the center of motion on which the springs vibrate: these parts of the springs must be placed in a radial line between the center of vibration of the pendulum and the end of the cross bar *w w*, so that when the ends of the cross bar *w w* act against the pins 8, 9, 10, or 11, there will be no motion or friction between the pins and the ends of the bar. Lastly, at 15 in the pendulum rod above the cross piece *w w*, is a stud with a single tooth, which acts in a corresponding notch 16, on the upper edge of the said cross piece *w w*, and may be moved to the right or left by means of a key or lever which accompanies the clock; so that the clock may thus be put into exact beat, or meet with the pins 8, 9, and 10, 11, at equal arcs of vibration, counted from the point of quiescence; and when the adjustment is once made where the clock is firmly fixed, the situation of the cross piece *w w* is rendered permanent by the fixing screw *y*, which may be turned by the same key.

After this minute description of all the acting parts of the mechanism, it will not be difficult to understand the nature of their action: suppose the pendulum in its place, and put into beat by the adjustment of the cross piece *w w*, let the weight be suspended in the usual way, while the pendulum is at rest; then the impulse given to the pallet or escapement wheel will bring the nearest tooth in contact with the pallet *m*, which it will raise a small space, in sliding along its face, till the preceding tooth falls on the locking pin of the detent *i*, in which situation all motion will cease; the tooth which raised the pallet *m* not having

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escaped; the pendulum then being in vibration towards detent *i*, the end of its cross piece strikes against the two pins 8, 10, of the detent and pallet springs; the former is first struck, and the detent *i* being on the same spring, is now discharged, and the wheel is unlocked, and consequently at liberty to run on by means of the force applied through the train of wheels; but pin 10 is also struck at the same instant, and the wheel escapes from the pallet on which it before rested; at this instant while the pendulum goes on to complete its vibration, in opposition to the united forces of both the springs *i* and *m*, a tooth at the opposite side of the wheel meets with the face of the pallet *n*, and throws it outward, by sliding along it till the preceding tooth falls on the detent *j*, when the wheel is again at rest, with the acting tooth *p* supporting the pallet *n* in the same way as pallet *m* was before supported: presently the pendulum having made its excursion, returns, and is now impelled by both springs acting on the end of the cross piece *w w* during the whole of the return, till the detent *i* meets with the end of the banking screw *l*, which stops it: but the pallet spring *m* continues its action somewhat longer, till it falls on the end of the tooth 17, at the lower end of its plane: here the pendulum wants upwards of half a degree yet to descend, before it reaches the lowest point, where the velocity and consequently where the momentum is a maximum: after having passed this point, the pendulum will proceed somewhat more than half a degree in its ascending arc in a free state, before the other end of the cross piece *w w* strikes against the pin 9 of the spring detent *j*, and almost immediately after against pin 11 of the pallet spring *n*; this stroke will unlock the detent *j* and suffer the wheel again to escape, and while the pendulum is finishing its alternate vibration, in opposition to the united forces of both the springs *j* and *n*, the tooth next succeeding the tooth 17 that commenced

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action, will in its turn raise pallet *m* until the next before it falls on the detent *i* again, and stops the wheel; in the mean time the second excursion is completed and the pendulum returns, urged by the united forces of both the springs *j* and *n*, until the banking screw *l* arrests the motion of the detent *j*, and then the pallet spring acts alone for a short time, till the lower end of its plane falls on a tooth as was before described. Thus, when the pendulum is once put into motion so as to vibrate nearly two degrees at each side of the lowest point, it will continue to unlock the detents alternately, and to have its motion successively retarded in the ascent, and accelerated in the descent, as long as the force continues in action by which the pallet wheel is made to raise or throw out the pallet springs; that is, until the clock wants winding up. After this description of the action of my escapement, it may be asked, perhaps, how does it appear that the pendulum will not come to rest, since the weight which usually constitutes the maintaining power with the dead beat and recoil escapements, is here quite detached from the pendulum? I answer, that as the pallets *n* and *m* are both in their turns moved a little from their state of rest by the action of the teeth on their planes as the wheel revolves, the pallet spring does not oppose the ascent of the pendulum through so great an arc as it impels it in its descent, and the *difference* of duration of those two opposite actions or forces *maintains*, or keeps up the loss of force experienced from friction at the suspension, resistance of the air and other retarding forces. The detent spring, however, accelerates and retards in each vibration precisely the same quantity.

I come lastly to say a few words on those properties of my escapement, which I conceive to be peculiar to it, and which in my own estimation constitute its excellence.

I first take for granted, what has been experimentally

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determined by men of science, that the action of any uniform spring on a pendulum, moving in cycloidal or small circular arcs, is analogous to the effective part of gravity; and that therefore when such a spring is made to act conjointly with gravity, the effect produced by their joint actions, considered as an accelerating force, will be of the same nature as would be produced by one of them applied separately: the scale of acceleration or retardation will remain the same. Again, I assume that when any extraneous impulse is suddenly applied to a moving pendulum, the natural law of its motion depending on gravity, is least disturbed when it is applied to the lowest point, where the momentum is a maximum, and most at the extremity of the excursion, where the momentum is a minimum; and what is true of an impulse given, is equally true of a check received, or retarding force suddenly applied. Now, in my escapement the action of the springs begins and ends, not indeed exactly at the lowest point of the total arc of vibration, but within about half a degree of it, and as this distance depends on the length of the cross piece *w w* of the pendulum, it might be made still smaller without coming at the practical limit. As my pendulum is actuated, the vibrations are uniformly steady throughout; and while the clock has power to raise the pallets at each vibration, it will not cease to perform, when duly adjusted for beat.

Secondly, the force of the pallet and detent springs can be increased or diminished to suit the momentum of the pendulum used, by means of the four screws *t t* and *s s*, that fix these springs to the triangular cock; the screws *t t* being tapped into the tails of the springs, and thrusting against the triangular cock *r*, whilst the others *s s* screw into the cock and bind the springs fast.

Thirdly, the pendulum has the same center of motion as the said two springs, so that when the cross piece of

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the pendulum is moving in contact with the pins 9 11, and 8 10, no friction takes place at the parts of contact.

Fourthly, the locking is much more safe than in most of the other remontoir escapements; for here the detent has arrived at its place and is at rest, before the tooth to be locked arrives at it, consequently there is no danger of any tendency to rebound as is the case when two moving bodies come in collision.

Fifthly, the unlocking is easily performed by a direct stroke of the cross piece, made at right angles to the length of the moving pendulum.

Sixthly and lastly, the pallets being constructed without any heel piece or fang, the escape is effected without any impediment or recoil.

The shape of the teeth of the wheels and *pinions is* as nearly epicycloidal as possible; which I consider an essential requisite to their freedom of action, but which is too much neglected in clock and watch work in general; and the pivot holes of the escape wheel are jewelled.

In order to limit the action of the detent and pallet springs to a certain point, besides their being thinned away at that part of them, holes are made through them also, which determine the point of action.

As I prefer the mercurial pendulum to any other hitherto known for my regulators, I have here given a correct outline of one after the manner I most approve of fitting it up.

Plate XXXVII, fig. 1, is a front view of a mercurial pendulum, having the upper part of the rod removed, as shown by the fracture.

Fig. 2 is a side view of the same: *x x* is the bottom part of the pendulum rod, which is made of steel, and passes through a hole in the upper end of the frame A, which supports the glass that contains the mercury; the rod is well fitted into the hole, so as to have no shake, but

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is at liberty to slide through it; on the bottom end of the rod is a screw and micrometer head or nut B, which is divided on the upper side to adjust the length of the rod; C is an index which coincides with the divisions on the micrometer plate; D D are two parallel steel rods, which form the sides of the frame, and are fixed to each side of the head A, which is likewise made of steel; to the bottom ends of the rods is fixed a brass cup E, which receives the bottom end of the glass cylinder E F, in which the mercury is placed; the dotted lines G G represent the inside of the cylinder, the dotted line H H the altitude of the mercury; I is an iron cover or lid, having a brass ring fixed to the under side of it, which receives the upper end of the glass cylinder, and on the upper side of the lid are fixed two pieces J J, with notches to receive the sides of the frame D D, which steadies the upper end of the glass. To the bottom part of the frame E is fixed an index K, which indicates the degrees of vibration on a brass arc, which is divided into degrees, and fixed to the back part of the case of the clock.

These views of the pendulum are drawn to real size.

As the whole length of the pendulum rod is not shown in the drawings, it must be nearly 39¼ inches from the point of suspension, or vibration, to the center of oscillation to beat seconds in London.

I do not here think it necessary to explain the properties of the mercurial pendulum, as it is already well understood.

I have here subjoined a description of a simple pitching or deepening tool, which I contrived for marking off the proper distance for planting my escapement, and which is applicable to escapements of any other form. I also find it of great service in setting the depth of wheels and pinions, where the pinions are made separate from their arbors.

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When I undertook to make the Greenwich clock, I was in hopes of getting a movement all finished and ready for applying my escapement to it; but, on examining the works, I soon found it would not answer my expectations.

The wheels and pinions were all finished by hand, and the usual way of pitching them was, first to set them deep enough, and then to round up a few teeth and make a trial, and if too deep, to reduce the wheel till they ran smooth.

I mention this circumstance in hopes that this practice will be discontinued.

The objection I found the clock-makers had to wheels and pinions finished in the engine, was, the great difficulty of setting them to a proper depth; but by the means about to be described, that objection will be obviated, as a tool of this description is so easily made, that no clock-maker need be without one. For mathematical instrument makers also, this tool will be found of service for setting the depth of their racks and pinions more readily and certainly than by hand.

Plate XXXVIII, fig. 1, represents a front view of the pitching or deepening tool, with my escapement applied to it.

Fig. 2 is a side or edge view of fig. 1; A A is a flat parallel plate of brass, in the center of which a short cylinder or arbor B C is fixed, projecting on both sides and at right angles to the plane of the plate; on the end C of the arbor is fitted the escapement wheel *g*; between the plate A A and the wheel *g* is fitted a parallel plate or collar D of brass, to adjust the height of the wheel to the two spring pallets *m* and *n*; on the other side of the plate A A is fixed a flat bar E E, by the screw F, which screw passes through a parallel slit G G in the bar E E, and screws into the plate A A: the neck

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of the screw F is equal in diameter to the end B, which also passes through the slit, and is also equal in diameter to the width of the slit G G; to the upper end of the bar E E is fixed the adjusting plate *q* of the escapement (to which the cock *r*, together with its two spring detents *i* and *j*, and the two spring pallets *m* and *n* are affixed) by means of the screw H, which passes through the slit G G, and screws into the hole 18 in the adjusting plate *q* (see figs. 8 and 9, plate XXXVI). The screw 19 passes through the hole 18 and screws into the back of the frame plate C, and fixes the plate *q* thereto, which has two steady pins I I to prevent its turning on the screw 19 (see plate XXXIV and XXXV).

On the ends of the screw H and the arbor B are made conical centers.

The method of using this instrument for pitching my escapement is as follows:

First make fast the adjusting plate *q*, together with its cock *r* and appendages to the upper end of the bar E E, by the screw H; then place the escapement wheel on the end C of the arbor B C, and slide the end B of the arbor along the groove G G, till the teeth of the wheel are properly adjusted to the two spring detents *i* and *j*, and to the two spring pallets *m* and *n*, that is to say, when the drop of the teeth of the wheel to the detents *i* and *j* are equal; then make fast the plate A A to the bar E E by the screw F; apply then the conical end of the arbor B to the hole in the frame plate C, through which the axis of the escape wheel passes; describe then an arc across a line drawn perpendicular to the center of the escape wheel with the point of the screw H, which will give the distance of the hole in which the screw 19 screws into the frame plate C, and which affixes the adjusting plate *q* with its appendages thereto.

On the lower end of the bar E E is fixed a socket J,

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which contains a cylindrical arbor K, on which the pinions are placed when the instrument is made use of for pitching wheels and pinions with holes in their centers. When the pinion is placed on the socket K, and the wheel on the end C of the arbor B C, the end B must be slid along the groove G G, till the teeth of the wheel are properly in contact with those of the pinion; then the conical center of the arbor B must be applied to the hole in which the axis of the wheel is inserted, and an arc described by the center L of the arbor K, which will give the distance between the centers of the axis of the wheel and the axis of the pinion.

The plate A A may be moved along the bar E E, by a screw and micrometer head, so as to adjust the pitch of the wheels to the greatest nicety.

Fig. 3, plate XXXVIII, represents the face or side view of an instrument which I make use of in adjusting the faces of the teeth of the escapement wheel, with a wheel applied to it. Fig. 4 is an edge view of the right-hand side of fig. 3; this instrument consists of a flat plate M M, having a cylindrical stud N fixed in the center, which fits the hole in the center of the wheel, and on which the wheel is placed: on the projecting and back part of the plate M M is fixed a hard steel plate O, by the screw P, the upper part of which projects over the upper edge of the plate M M, and is level with its face; the upper side or face of the piece O is at right angles to the face of the plate M M, and is at liberty to turn on the neck of the screw, when the screw is eased, so as to make the surface coincide with the inclination of the face of the tooth Q of the wheel. Fig. 5 is a side view of the piece O, and fig. 6 is an end view of the same; R is another piece of steel which is fixed on the front side of the plate M M, by the screw S, and has a projecting tooth which acts against the upper side or face of the tooth T of the

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wheel, and must be so adjusted that the upper side or face of the tooth Q of the wheel coincides with the face of the steel plate O; then the face of the tooth Q must be filed off level with the face of the plate O, and when finished the wheel must be raised up from the plate till the tooth Q of the wheel can pass over the piece R; then the wheel must be pressed down to the plate M M, and the upper side or face of the tooth Q must be brought and kept in contact with the under side of the tooth R; then the face of the tooth U will coincide with the face of the plate O, and must be filed as before described, and so on till the whole of the teeth of the wheel are completed. Fig. 7 is a side view of the piece R, and fig. 8 a view of the upper edge.

I think it proper to add, for the benefit of the time-piece and regulator makers, that I have enabled Mr. Thomas Leyland, clock-maker, of Prescot, in Lancashire, to cut wheels and pinions with teeth made truly epicycloidal, from patterns generated by myself, and also to make and fit up regulator movements complete.

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PAPERS

IN

COLONIES AND TRADE.

N° I.

SCOTCH HERRINGS.

The sum of FIFTY POUNDS *was this Session given to Mr.* J. FRED. DENOVAN, *of Aberdour, in Scotland, for his activity in getting into the Hamburgh Market a cargo of* SCOTCH HERRINGS, *previous to the arrival of the first cargo of Dutch Herrings; and also for the superiority of his Scotch Herrings to those imported by the Dutch fishermen, as proved by the higher price obtained for the former. The following communications have been received from the candidate on the subject.*

Aberdour, Fifeshire,
Feb. 12, 1820.

SIR;

WHEN I had the honour, in October, 1818, of transmitting to the Society a half barrel of herrings for their inspection, I promised, in making my next year's offering to His Royal Highness the Prince Regent (now His Ma-

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jesty King George the Fourth), to send to the Society a specimen of the same herrings (of the early species), and which I anticipated, from the arrangements I had made, would be the first herrings taken on the coast of Great Britain. In conformity with that promise I transmitted to my agents at Leith, to be forwarded to the Society, a sixteen gallon barrel of these herrings caught and cured by me, in the Frith of Clyde, on the 14th day of June, 1819; and perceiving from a printed copy of the Regulations sent me in Spring, 1819, that the Society generously offered to extend the same premiums for another year, I have presumed again to become a candidate, and to submit to the consideration of the Society a narrative of my proceedings, to the successful issue of which I proudly and gratefully acknowledge the Society have powerfully contributed.

I am sorry, however, to find, from my correspondent in London, that the specimen of herrings, owing to some accident or mistake, has been much longer in reaching its destination than I expected; and I have also to regret, that just while I was about to sit down to address you, I was subpœnaed to give evidence in a civil trial, by jury, in the West of Scotland, regarding the loss of a vessel, which has detained me until now; I can therefore only submit myself to the indulgence of the Society for the delay that has unavoidably taken place.

In my former letter I fully explained to the Society that the object of my undertaking was to obtain a preference for the British white herring fishery on the continent of Europe, by endeavouring to anticipate the Dutch, by importing into Hamburgh an article equal in every respect, if not superior, to what they had been in the habit of vending in Germany for at least two centuries past; and having at the same time given, by affidavit, a full description of the process employed, I feel it unnecessary to swell

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the present communication by a repetition of what is already in the possession of the Society; but every deviation from, or improvement on, the original process shall be distinctly explained.

Early in June 1819 I freighted the sloop Mary Ann, of Glasgow, John Macfarlane master; and having provided her with the necessary stores, proceeded to the Frith of Clyde, where, after shifting about from bay to bay, and head to head, I fell in with the first small shoal of herrings, on the morning of the 14th of that month, off Tarbet; and having made signals to the fishermen, had about three barrels on board in the course of the day. Of these I packed up the half barrel for the Society, and the quarter barrel for the Prince. From the pains I had taken during the three years preceding in instructing both the fishermen and their sons, in this neighbourhood, in the Dutch mode of gutting, assorting, laying, packing, re-packing, and pickling the herrings, I conceived I might safely try the experiment without having resource to foreign aid, and the result has fully justified my expectations. To satisfy the Society on this point, I have the honour to produce a certificate from Messrs. M. and A. Mac Laren, fish curers in Glasgow, the proprietors of the Mary Ann, and from whom I freighted her, proving that this was the case; and also certifying the quantity of herrings cured by me on board the vessel for exportation to Hamburgh. Having, on the 24th of the same month, taken altogether about fourteen barrels, sea stock, which were re-packed into eleven whole barrels for exportation, exclusive of the half and quarter barrel and a few kegs for home consumption, I proeeeded to Glasgow, which I reached on the 26th, and forwarded my herrings to Leith, where they were shipped on board the smack Courier, John Henry master, for Hamburgh. After landing my herrings at Glasgow, I returned again to the Frith of

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Clyde, and having taken, cured, and repacked for exportation thirty-five and an half barrels more, I came back to Glasgow on the 10th of July following, pushed on to Leith with what I had taken, and shipped 34 barrels to Hamburgh, by the smack Glasgow, Walter Paton master, retaining one barrel and a half for the supply of my friends at Edinburgh, in kegs.

It is singular, although the finest herrings in the world are to be had in abundance on the coast of Scotland, that the natives had never been stimulated to profit by the advantages they possess, while this very herring fishery became, as it were, an inexhaustible source of wealth to a foreign nation, who, to use their own words, founded their metropolis on herring bones! but that the subjects of Great Britain should have tamely and supinely submitted to the disgrace of seeing a foreign nation take away these very herrings from their doors, to supply a foreign market which it was their birth-right to have filled; without once reflecting that the Dutch had to fit out large deep sea vessels, at a very great expense, to accomplish an object which a poor Scotch fisherman might have effected with his little boat; and that every barrel of herrings drawn from the sea was so much real wealth acquired by the nation.—Remarkable as this may appear, it is nevertheless a fact which will not admit of contradiction; and that for upwards of two centuries past, the Dutch have not only imported (if I may be allowed the expression) the first Scotch herrings to Hamburgh, but have found means to maintain such a preference in the German market, that British herrings, although caught in the same water, never brought above *one-third* of the price at which Dutch herrings were sold; while, in consequence of the small profit earned by the exporter, QUANTITY and *not quality* was considered an object; and if the curer, from the extent of his capital, could afford to

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send over 3 or 4,000 barrels, he was remunerated for his trouble, by receiving the 4*s*. per barrel of bounty paid by government, if he got no more; and contented himself with endeavouring to *undersell* the Dutch by glutting the market with an inferior article. Yet to imitate the Dutch, in their mode of cure, was even with these very men *considered to be nonsense*;—they held up their herrings to be as well cured as the Dutch; while the idea of anticipating the Hollanders in the German market was not only thought ridiculous, owing to their using busses, but even in June last, when I set out on the fishing, I was told by two of the first-rate curers in the West of Scotland, and who have *amassed fortunes by curing quantities*, that the thing was impossible; and that no herrings were to be found in our bays, *in condition for curing*, until the months of July or August.

I am proud however to say that my favourite scheme has at length opened the eyes of my countrymen, and that my humble endeavours have at length been crowned with success. My first shipment of eleven barrels reached Hamburgh on the 4th, and they were exposed to sale on the 5th of July, before the Dutch with a fleet of 269 deep sea busses had brought a herring to that market. It is customary in Hamburgh, as in Holland, to ring the bells in the steeples on arrival of the *first* or *new* herrings; but this was the only occasion on which the bells of that city had ever proclaimed the arrival of *British new herrings*, which were sold at the enormous price of *fifty dollars per barrel!*

Some gentlemen, I believe, from London, who were desirous of making a similar attempt, contracted with the curers in the neighbourhood of Lochfine, to cure for them a quantity of herrings for the Hamburgh market on my plan, but these curers, bigotted as it were to their own system, induced these gentlemen to believe that their

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mode of cure was equally good, and prevailed on them, to send out the herrings in that way, in the hope of obtaining as high a price; but the certificate (which I have now the honour of producing) under the hand of the *first* fishmonger in Hamburgh, and certified by the British Consul, will prove that both these fish-curers and their employers were widely mistaken in their ideas; and one of the former has since called on me, and not only expressed a conviction of his error, but has made overtures to me to cure in conjunction with him next year, when he will be guided by my advice.

A great commercial house at Hamburgh having the preceding year purchased a part of my herrings in that city, and calculating on the probable success of such an undertaking, and of the profit that might be expected to result from an importation of herrings cured in the same way, sent over to Scotland a number of German herring packers, who being assisted by a British curer in the Frith of Clyde, cured and sent to Hamburgh a considerable parcel of herrings; but owing to the injudicious manner in which the fish were gutted and packed, and the bad quality of the salt, a few barrels only sold at 60 merks, while the remainder were disposed of nearly at cost price.

After both these parcels had been sold, and after three cargoes of Dutch herrings had come to market, my second shipment, consisting of 34 barrels, reached Hamburgh. It must be allowed that they came then at a disadvantage, and had nothing but their quality to recommend them; yet, as is proved by the certificate before mentioned, they sold at from 90 to 120 *merks per barrel*, which clearly established their superiority in point of cure, to the shipments which had been previously made both by the Dutch and by those who had become my opponents.

Although it is highly gratifying to my feelings to re-

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flect on the success I have had, and that I am the *only British subject* who has conquered the Dutch at their own weapons, in a branch of trade peculiarly our own, and which may be productive of great national advantage; yet it becomes a duty on my part to acknowledge with gratitude the protection and support I have experienced from the liberality and discernment of the Society. It would pain me to think, that I offered only flattery where sincerity was due: no doubt many compliments are in this way paid to the Society by individuals like myself, who have experienced their bounty; but they should not be despised—to return thanks to his benefactor is but too often all that a poor man can do; and I hope, in doing as others do, it may be believed that my offering is at least genuine.

When I first addressed the Society I candidly explained to them the difficulties I had to combat, and the loss I had sustained by the failure of a Hamburgh house to whom my herrings were consigned. When I embarked on my undertaking in May last, my finances were extremely slender, so much so that I hardly knew how to manage; and therefore the Fifty Guineas voted me by the Society operated not only as a stimulus to exertion, but as a most seasonable assistance in promoting the success of my undertaking. While thus I acknowledge with gratitude the liberality of the Society, I flatter myself they will not disdain to participate in the triumph of an individual who owes, in a great degree, his success to their bounty.

Most men are anxious to conceal their poverty; but situated as I am, I feel proud in avowing it. It has been generally believed that a poor man had no chance of enriching himself by the white herring fishery; and that, for the reasons before stated, men only of capital could embark in it with success; but I flatter myself I have not

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only exposed the fallacy of an opinion, which has been productive of the most pernicious effects, but demonstrated to the country at large, that every poor man may enrich himself by the fishery, if he will only be industrious and persevering. He must not, however, as too many have done, *depend on quantity*, and *on the 4s. bounty* to be received from government. He must be attentive as to *quality* and *cure* for his remuneration; and, instead of leaning on government for support, he must, as I have done, seek for bounty in the markets of a foreign nation.

Having received immediate remittances for my two shipments from Hamburgh, I left the Frith of Clyde, and proceeded to Dunbar, where herrings were got in great plenty, and at a much lower price. I cured, *with British subjects, openly and publicly, on shore, so as every one might learn and profit by my example, one hundred and forty barrels*, of excellent herrings, which were shipped for Hamburgh, by the smack Albion, Parker, master. These herrings, although the Hamburgh market was then very full of inferior British fish, would, I am convinced, have left a very handsome profit; but the vessel was unfortunately stranded on the island of Ameland, on the Dutch coast, and I was disappointed in my hopes of gain: having, however, effected insurance on the parcel, and recovered from the underwriters, I have suffered nothing by the disaster.

In proof of these facts, I have the honour to lay before the Society a Certificate from Messrs. Kelly and Sawers, most extensive and respectable fish curers at Dunbar: men who were formerly bigotted to their own system, but from having paid great attention to my movements, while at Dunbar, have publicly expressed their desire to imitate my example in future; and the Certificate

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now produced, distinctly explains their opinion as to the superiority of the plan adopted by me.

I have also the honour of laying before the Society a letter from the right honourable Sir Benjamin Bloomfield, bart., written by desire of his then royal highness the Prince Regent (now his Majesty, King George the Fourth), acknowledging receipt of the quarter barrel of herrings; and I am assured from high authority, that my herrings have not only become of use, but are a standing dish at the royal table.

I could have forwarded to the Society a much finer specimen of herrings than those contained in the half barrel, had I waited until the season was further advanced, and the herrings had become more full, and attained a greater size; but I promised that the Society should have a fair specimen of the *first fruits* of my labour, and I have kept my promise. It is a very easy matter, in the middle of the season, to put up a barrel, or half a barrel, of superior herrings; but I have the honour of laying before the Society *a fair specimen* of herrings *actually caught and cured on the* 14*th of June*, nearly a month before the British curers commence their operations, and *ten days* before the Dutch statute permits a subject of that country to cast a herring net in the sea, on the foolish and superstitious notion that herrings are not in a condition to be cured before the Eve of St. John. I pledge my honour that the herrings now sent, are a fair specimen of those forwarded to the Prince Regent; and of those shipped to Hamburgh, for which the price of fifty dollars per barrel was paid; and I flatter myself that no such specimen, of *early herrings* can be produced by any Dutch or British curer whatsoever; and I pride myself the more in this, from the fact which will be admitted by every man conversant with the curing of herrings, that owing to the great quantity of fixed oil

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they contain, more care and attention is required in curing *one* barrel of early herrings, than *twenty* of the later species, which are taken in September and October. And I further pledge my honour, that the whole of the herrings cured by me last season, were done in the same manner as those in the half barrel, without any difference in the process, saving and except the diminishing or increasing the quantity of salt, as the fatness or leanness of the fish required it.

Having often observed the strong antiseptic powers of moss water, on vegetable and animal substances, I conceived that it might be used with effect in the cure of herrings, particularly of those intended for a warmer climate, and I resolved to try the experiment on a small scale: I first cured a few kegs of the later herrings (in October 1818) in the usual way; but, instead of throwing away the gut, gills, and bloody part, as is customary, I put them into a small cask, with a proportionate quantity of Lisbon salt, and pressing down the whole by means of an iron plate, a dissolution of the salt took place in a few hours, and a strong red pickle was produced, on the top of which the fixed oil was floating. After carefully skimming off the oil, I added one third of strong *brown* moss water, taken from a natural pond formed in the Moor near Eyemouth; and having taken the herrings out of the original pickle, I packed them anew, and filled up the kegs with this pickle. On opening them some months afterwards, I not only found they were in excellent preservation, but that the scales (which always proves the quality of the pickle) were as bright as when the fish were taken out of the water. I presented one of these kegs to my respected patron, the Earl Morton, who has generously given me some premises at this village, *rent free*, to facilitate the progress of my undertaking. I also sent a keg to Sir John Sinclair, bart. who had had

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several conversations with me on the subject of the fishery; and the third I kept until the latter end of May 1819, when the weather was very hot: on opening it, I found the fish *in* PERFECT *preservation*; and I sent it to the right honourable the Lord President of the Court of Session: his lordship is reckoned a connoisseur in herrings, and was not only consulted by the late Mr. Rose, in framing the Deep Sea Fishery Bill, but was president of the Fishery Board for many years. I have the honour of producing returns from Earl Morton and the Lord President, expressing their opinion of the quality; as also, a letter from Sir John Sinclair, animadverting on the species of the herrings, as being full of milt and roe, in which he is perfectly correct (for as I have observed they were taken in the latter part of the season) and expressing a hope that I should be able to cure a superior article *early* next season, alluding to *early herrings*, such as I have now had the honour of sending to the Society. Sir John also adverts to the use of moss water, not only in the cure of herrings, but also in preserving meat and butter, and believes it might be greatly strengthened by evaporation. I have since had different conversations with Sir John on this topic, and intend this season to give the thing a fair trial; for during the last summer it was not in my power to make arrangements for this purpose. When I have brought the matter by repeated experiments to some kind of maturity, I shall have the honour of communicating the result to the Society.

Although various schemes have been tried to preserve herrings in the warm climates, they have never, as far as I can learn, been attended with success; and although the pickle prepared with moss water may be extremely serviceable in shipments made to the Colonies, still I am of opinion that a different treatment of the fish will be necessary to bring about this desirable object: if the

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operation of gutting had the effect (as is erroneously believed) of opening the whole blood vessels of the body and head of the herring, a strong antiseptic pickle, judiciously used, would undoubtedly carry the herrings to any climate in the world; but in dissecting the herring, it will be found not only that the head contains several smaller vessels, but that a LARGE *blood vessel* from head to tail of the fish lies behind the back-bone, with which the gutting-knife never comes in contact, and which of course are not discharged during that operation. This large blood vessel, as may reasonably be conceived, soon yields to the heat of the weather, and blackens the bone; and the spine and brain being next affected, the whole fish becomes immediately rancid and unwholesome.

If the herrings, however, when gutted were laid on a board, by dozens, and THE HEADS CHOPPED OFF *with a large knife*, and cured in the manner I have stated, with moss water, I am confident they might be conveyed to the East or West Indies, in as high perfection as to Hamburgh; and if our colonists would only reconcile themselves to the idea of eating herrings *without heads*, they might enjoy them in as great style as a burgomaster of Amsterdam.

These my humble efforts to improve the cure of, and to obtain a preference for British herrings, I submit with deference to the consideration of the Society; and grateful for the liberality I have already experienced, fondly hope they may be honoured with their approbation. I have the honour to be, with much respect,

Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. J. FRED. DENOVAN.

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CERTIFICATES.

Hamburgh,
December 15, 1819.

THESE are certifying all whom it may concern, that Mr. J. F. Denovan, of Aberdour, in Scotland, imported to this city, on the 5th of July last, by the smack Courier, of Leith, Thomas Henry master, eleven barrels of early Lochfine herrings, cured in the Dutch manner; which herrings arrived in this port previous to the jagers of the Dutch Deep Sea Fleet, and averaged the price of fifty dollars, Hambro' currency, per barrel: and it is further certified, that no British subject has ever before outsailed the Dutch, or made such an early importation; neither has such a high price been before obtained for British herrings.

That shortly after Mr. Denovan's parcel was sold, several importations of Lochfine herrings were made to this port, and were sold on an average at 32 and 34 marks per barrel; while a second importation of Mr. Denovan's, on the 23rd of July, by the smack Glasgow, W. Paton master, of thirty-four barrels of Lochfine herrings, cured by him, were sold from 90 to 120 merks per barrel; and the superiority of Mr. Denovan's method of curing was proved more distinctly this season, when compared to an importation of about 70 barrels, cured likewise by Dutchmen, which did reach our market about the same period, out of which only 20 barrels fetched from 48 to 60 merks, the remainder from 32 to 36 merks per barrel; and there is little doubt, if Mr. Denovan is enabled to persevere, that his plan must ultimately have the effect of enhancing the price and conducing to the establishment of an extensive market for the sale of British herrings on the continent; by which means the Dutch herring trade might be successfully opposed, provided Mr. Denovan is sup-

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ported in his undertaking by legal permits to *supply himself with the proper materials, the ensuing season, on a larger scale.*

J. LOUIS BERTHEAU,
for JURGEN BONA MEYER,
Fish Curers.

Hamburgh,
December 16, 1819.

These are to certify that this day personally appeared before me, at the British Consulate General in this city, Mr. J. Louis Bertheau, having the full power of Messrs. Jurgen Bona Meyer, fish curers of this city, and made the above declaration, and that the above signature is his proper hand-writing.

J. C. MELLISH, *His Majesty's Consul General.*

Hamburgh,
May 13, 1820.

I, THE undersigned Jurgen Bona Meyer, fishmonger in Hamburgh, complying with the application made to me to give some further information concerning Mr. J. F. Denovan's importation of early herrings, consigned to me last season, do certify and attest that 11 barrels shipped per the Courier, Thomas Henry master, arrived on the 5th of July, before the Dutch jagers from the Deep Sea Fleet had made their appearance: five of these barrels were sold the same day to the inland dealers at sixty dollars currency, and the remainder went off readily in small parcels by retail, and also in small kegs to the inland carriers, the contents of the whole lot amounting to 1,142 mark banco.

That the barrels in which these herrings were contained were of common size; they were, however, of oak, and

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hooped in the Dutch manner. Dutch and British herring barrels are nearly of the same dimension, but the Dutch are made of well-seasoned oak, while those of the British are made from different woods, and some of them from fir, which not only injures the fish, but generally absorbs the pickle.

Mr. Denovan's second importation of 34 barrels of Lochfine herrings per the Glasgow, Walter Paton master, were received on the 23rd of July: this shipment, however, had materially suffered from the voyage; several barrels had staves broken in, which rendered the contents of 6 barrels unmerchantable, and a similar accident had also happened to one barrel of the first importation: ten barrels were sold to the inland dealers at forty and thirty dollars currency, and the remainder was partly sold by public sales at 85 marks, and partly retailed in small kegs to the inland carriers, making the contents of the whole shipment amount to 2,214 mark banco.

On the 12th of July the Dutch jagers reached port, and up to the 1st of August were paid with fifty dollars currency per barrel, although they were not first quality; but this is not to be wondered at, considering the connexion and interest which the Dutch have in this port, and the deep-rooted prejudice entertained by the consumers against herrings imported from Great Britain. The first Prussian jager of a very fine fish fetched only seventy mark currency per barrel; and on the 14th of July early Lochfine herrings were brought to public roup by a Scotch gentleman, and only a single barrel went off at 53 marks: the sale was withdrawn without leading to a more seasonable result. While such is the nature and the situation of the British trade upon our market, Mr. Denovan's bold and well-managed attempt has, however, had the effect to open the eyes of many: should he persevere steadily, and should his example be followed by his coun-

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trymen with *due circumspection*, there is little doubt but a new mine of wealth will be opened to the industry of the British nation, and he and his countrymen are heartily welcome to my best exertions for their interest.

I embrace this opportunity to refer every one, interested to support Mr. Denovan's well-concerted projects, unto Mr. Bertheau, whom, by his experience and knowledge I deem most competent to afford effective assistance towards the attainment of the object the Honourable Board of Fishery contemplated, when it recommended the adoption of the Dutch method of curing, the expediency as well as the importance of which, proves to be most satisfactorily substantiated by Mr. Denovan's patriotic endeavours.

JURGEN BONA MEYER.

These are to certify that the signature Jurgen Bona Meyer, on the other side, is the proper hand-writing of Mr. Jurgen Bona Meyer, a citizen and fishmonger of this city. Witness my Hand and Seal of Office.

In the absence of the Consul General,
CHAS. WESSELHOEFT, *His Majesty's Vice Consul.*

Dunbar,
January 20, 1820.

THESE are certifying all whom it may concern, that, in the month of September last one hundred and forty barrels of white herrings were cured in our premises here, in the Dutch manner, under the direction of Mr. J. F. Denovan, of Aberdour, in Fifeshire, and that no Dutch fishermen were employed, either in taking, gutting, or packing the same; but that the whole operation was performed by natives of this place, under the orders and

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superintendence of Mr. Denovan, and a friend who attended in his absence.

As professional men, we give it as our opinion, that Mr. Denovan's plan is very far superior to the general usage of this country. The scales are preserved more entire, the fish retains its fine natural shape and juices, and the flavour is entirely different; and there can be little doubt, were his system adopted at the different fishing stations, that great advantages would be reaped by this country, in exporting herrings to the continent of Europe.

The herrings alluded to were intended for the German market, and were shipt on board the smack Albion, Parker master, for Hambro'; but the vessel was unfortunately stranded on the Dutch coast and the cargo abandoned to the underwriters. Although the German market was very much depressed by extensive exports from this country, still we are assured that had these herrings reached their destination, they would have brought a much higher price than those cured in the common way, with which Hambro' was then glutted.

KELLY & SAWERS, *Fish Curers.*

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SUPPLEMENT.

ON reference to Vol. XXVIII of the Transactions of the Society, page 179, will be found the description of an Improved Mathematical Dividing Engine, invented by Mr. James Allan, of Blewett's Buildings, Fetter Lane, London. The Society considered the improvements introduced into the engine by Mr. Allan, as deserving their Gold Medal, the highest reward which (according to the rules of the Society) can be conferred on one of their own members.

As a confirmation of the judgment passed by the Society, and as a testimony alike honourable to the skill of the Artist and to the liberality of the Board of Longitude, the Society willingly give a place in their volume to the following letter from Dr. Young, transmitted to them by Mr. Allan.

Admiralty,
February 3rd, 1820.

SIR;

I HAVE the pleasure to inform you that the Board of Longitude has this day been pleased to grant you the sum of one hundred pounds, as a reward for your ingenuity, displayed in the improvement of the dividing engine.

I am, Sir.

&c. &c. &c.

Mr. Allan. THOMAS YOUNG, *Sec.* B. LONG.

VOL. XXXIV.

THE references to Mr. W. Bremner's Instrument for the Extirpation of Polypi, plate 18, and to Mr. Jon.

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Dickson's Method of Propelling Steam Boats, plates 28 and 29, are omitted in the first edition of this volume, but have been inserted in the second edition of the same. In order that those who are in possession of the first edition may have the above noticed omissions as far as possible supplied, it has been thought proper to insert here the following descriptions:

Reference to the Engraving of Mr. W. Bremner's *Instrument for the Extirpation of Polypi,* Plate XVIII.

Fig. 7, the cannula and screw complete, with the doubled cord *x* passing through it. Fig. 9, the notch pointed probe. Fig. 8, the screw detached from the cannula; *s s* are two feathers at the end of the screw, which slide in the grooves *r r* in the cannula, sections of which are shown in fig. 10: *v*, fig. 7, the groove in the screw head to secure the ends of the cord *x*; *t*, figs. 7, 8, the nut, having a milled head, which being turned, causes the screw to advance or recede within the cannula; *w*, a screw the end of which works in the groove *u* of the nut and retains it in its place; *v v* a plan of the grooved screw-head.

Reference to the Engraving of Mr. Jon. Dickson's *Method of propelling Steam Vessels,* Plates XXVIII and XXIX.

1 1, a section of the vessel; 2 2, the float-wheels impelled by an engine acting on their shafts A B, having on each a toothed wheel, which acts on other toothed wheels fixed on the axis of the float-wheels. Each float-wheel is hung on a pair of levers 3 3, turning on the center C, coincident with the axes of the first-mentioned toothed wheels, so that although the levers are elevated at one end, and

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with them the float-wheels, yet the relative distances of the two toothed wheels are preserved, the one having what is called a planetary motion round the other. The left-hand float-wheel, (plate XXVIII), is shown dipping in the water, while that on the right hand is lifted out of it by the action of the winch E communicating motion, through two small wheels and two pinions, to the barrel 4 4, coiling round chains attached to the ends of the levers 3 3. The left-hand figure in plate XXIX, is a bird's-eye view, and the right-hand figure is an elevation showing distinctly the action of the levers 3 3, and their connexion with the toothed wheels. The dotted lines exhibit the positions of the wheels and levers when raised to their greatest height.

VOL. XXXVII.

The Society having last Session rewarded Mr. Russell for the application of Mr. Bramah's Lock to the purpose of locking liquor cocks, and it appearing that the description of the lock so applied, is not so complete as might be desired, the following additional explanation is published:

Very full and explicit engravings of the lock and its application are given in Vol. XXXVII, of the Society's Transactions, plates XI and XII, to which the reader is referred.

Figs. 2 and 3, plate XI, exhibit the external appearance of the cock so protected, in one case by the lock being affixed to the side, and in the other to the front of the barrel.

The manner in which the bolt *c*, figs. 1 and 2, plate XII, is advanced into, and withdrawn from the plug of the cock by the revolution of the barrel of the lock and the screw *b*, has been shown in the description accompanying the plates; as also has the nature of the slits in the key by references to figs. 20, 21, 22, and *d*, fig. 1, the two former

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20 and 21, being merely diagrams for the purpose of elucidating the principle of its action. It is now, therefore, only requisite to give a fuller exposition of those parts of the lock on which its peculiar security depends.

Figs. 1 and 2, plate XII, are full sized sections of the lock; these are evidently too minute and complex to admit letters of reference to the individual parts, which must consequently be described by their detached representations; and their relative situations in the sections may be discovered by an attentive examination of their several forms and uses.

Fig. 6 is a section, and fig. 7, an end view of what is designated the revolving barrel; in fig. 6 are seen the screw holes by which the circular plate attached to the screw *b*, fig. 15, is secured to it. The deep groove which is cut in the periphery of this barrel is occupied by two semicircular plates of the form fig. 11, and shown in an edge view fig. 12, making together the circle fig. 10, and this is called the locking plate; it is prevented from revolving with the barrel by means of the broad hoop, figs. 16, 17, the two projections from the end of which enter into the notches formed in the external circumference of the semicircular plates, fig. 11; the latter, therefore, cannot revolve without the broad hoop, which is prevented from so doing by being screwed at *h h*, fig. 1, to the outer case of the lock. The cylindrical stud which stands on the inner surface of the hoop, fig. 17, forms a stop to a small pin affixed to the circular plate, fig. 15, and limits the motion which can be given to the barrel, to rather less than one whole revolution; the stud and pin are both shown in the section, fig. 2, immediately on the right hand of the bolt *c*, the stud below, and the pin above that part of the screw which is visible. The dotted line in fig. 16, describes the relative situation of the locking plate when applied to the hoop, which is secured, as before

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stated, to the outer case of the lock; *a a* is the outer case in figs. 1 and 2, and it is shown separately in fig. 8, where the place of the hoop and locking plate is ascertained by dotted lines.

There are four (or any arbitrary number of) longitudinal grooves inside the barrel, two of which are seen in section, fig. 6, and the ends of all of them in fig. 7; these grooves, which approach in depth as near to the external circumference of the barrel as its requisite strength will permit, are continued through the locking plate, fig. 10: the peculiar indented form which they assume in the latter, will be hereafter accounted for.

Now, it will be easily understood that, inasmuch as the locking plate is fixed, if the longitudinal grooves in the barrel, and continued through that plate, are filled with slips of metal, the barrel will be immoveable. These grooves, therefore, are thus occupied by pieces called sliders, of the form, figs. 13 and 14, having a sort of hook or projection which advances to meet the center pin of the lock, in order to receive the action of the key, and against the underside of which, the plate *g*, fig. 15, presses, impelled by the spring *f*; the motion of the piece *g* is limited by the shoulder within the barrel, fig. 6, and when in this situation, the ends of all the sliders are in the same plane.

In order, however, that the sliders, figs. 13 and 14, may permit the revolving of the barrel when depressed to their respective stations by the key, one notch is cut in the outer edge of each, equal in depth to the distance which the locking plate projects into the longitudinal grooves, equal in width to the thickness of the locking plate, and at such irregular distances from the extremities, that the similarly irregular slits in the key may bring them all into the plane of the locking plate, which will then evidently not interfere with the motion of the barrel, because so

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much of the inner circumference of the locking plate as before opposed the motion of the sliders, and consequently of the barrel, will now be traversed by the notches just described. The small bit which projects from the key (*d*, fig. 1 and fig. 22) is received into an opening in the smaller part of the revolving barrel, fig. 7, and at the same time that it turns the barrel, limits the depth to which the key can be introduced into the lock; on its being withdrawn, the spring *f*, fig. 15, raises the sliders to their original level. Figs. 3, 4, and 5, are a side and two end views of the revolving barrel with the bolt, screw, spring, sliders, &c. in their places.

It will have been observed that there are two notches in the back of each slider yet unalluded to; their addition is one of the latest and most effectual improvements made to Mr. Bramah's lock in protecting it from surreptitious attempts. Their use can only be understood from a minute description of the methods employed in picking locks, which it is unnecessary to give here; suffice it to say, that by considerable skill and perseverance, and by taking advantage of the unavoidable inaccuracies of workmanship in articles of this description, it was possible in many cases to discover the requisite situation for the sliders to allow the turning of the barrel. It is, however, only right to state that all locks having tumblers or sliders, were exposed to the same defect, almost all admitted, and to many have since been applied a similar sort of remedy.

By the addition of these false notches (as they are called), which are not so deep as the true ones, and by widening the inner portion of the grooves in the locking plate, fig. 10, which allows a trifling degree of motion in the barrel, when the false notches are brought in the plane of the locking plate, it is totally impossible that the violator should know whether it is the true or one of the false notches which he has brought to the locking plate,

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the latter in fact are more easily so placed, and if there is but one in that situation the lock is still secure. Thus, by increasing the number of sliders and false notches, the difficulties of picking multiply in a rapidly increasing geometrical ratio to an almost infinite extent. It may perhaps render the subject a little more intelligible, to state that the circumstance from which arises the very great additional security obtained by the introduction of so simple and costless a contrivance as the false notches, is the impossibility of giving a simultaneous and just sufficient motion to the sliders of this, or the tumblers of any other lock, by any instrument short of a fac-simile of the key; the consequence is, that no small degree of dexterity is used in hanging (as it is technically termed) the tumblers or sliders one at a time on the edge of the locking plate, or on that which answers the same purpose in other locks; from this it will be perceived how fatal an obstacle the false notches are, which, as has been before stated, cannot in this operation be distinguished from the true ones.

Fig. 18 is a section across the barrel and sliders at the locking plate, the sliders being depressed to their proper depths by the key, and together with the barrel being in the act of turning round.

Fig. 19 is also a section in the same plane, showing the sliders with their false notches brought to the locking plate, the peculiar form of the grooves of which permits, as before mentioned, a very small motion in the barrel, but not enough to influence the bolt of the lock.

The edge view of the sliders in fig. 14, now only remains to be explained; it is obvious as all the sliders are acted on by one spring, that when one is depressed more than the rest (which is the case every time the key is introduced), all except that one are deprived of the support of the spring, and would when the lock was situated vertically, drop as far as the spring receded; to

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prevent which, they are constructed of two thicknesses of metal, a little opened at one end, forming of themselves a spring, the friction of which against the sides of the grooves retains them at any height unsupported by the spiral spring. This effect is illustrated in fig. 2, where the lower slider only, being that which is received into the shallowest slit in the key, is opposed to the spring, the upper one remaining at a distance from it, equal to the difference between the depths of the two slits.

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A LIST

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Fig. 2.

Fig. 1.

Fig. 3.

Mr. H. Stokes's Hydrometer.

Fig. 4.

Fig. 8.

Fig. 5.

Fig. 6.

Fig. 7.

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Mr. Wm. Bullock's

Drawn by R. Cocking.

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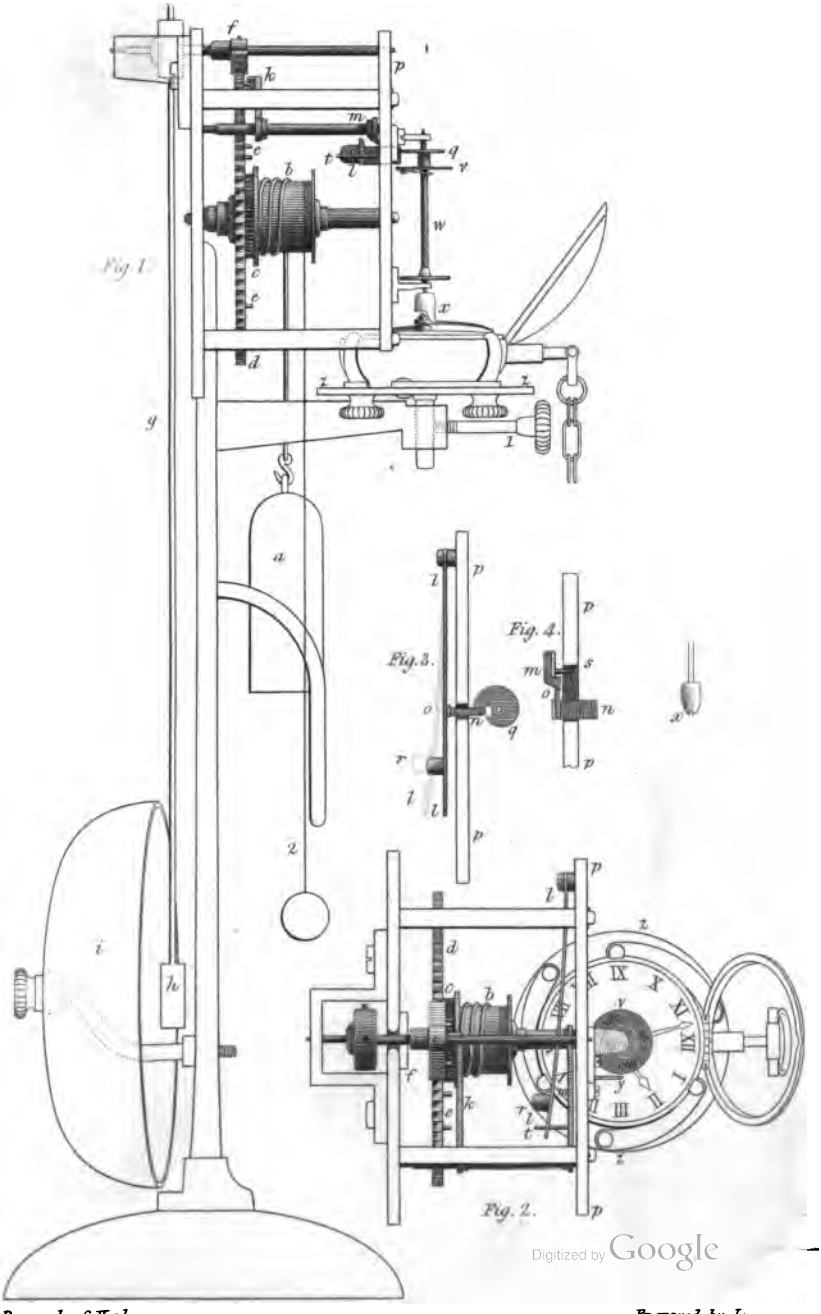
3 Mr. John Prior's Striking part of a Clock.



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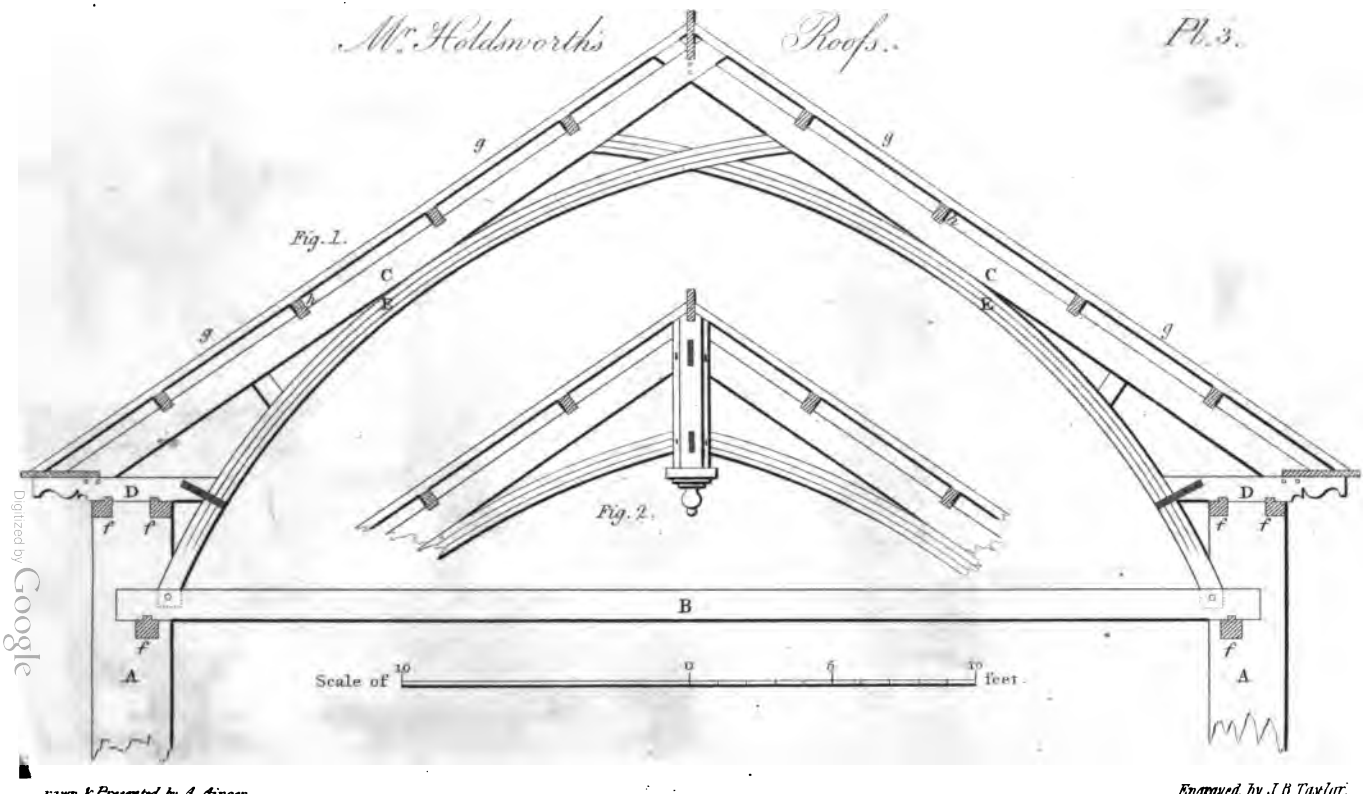

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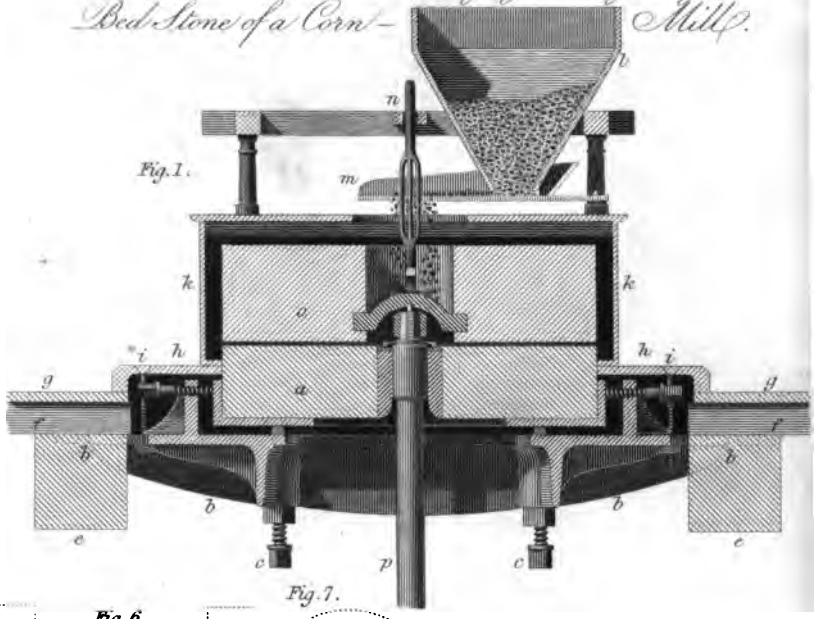
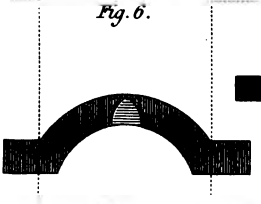
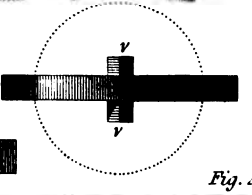
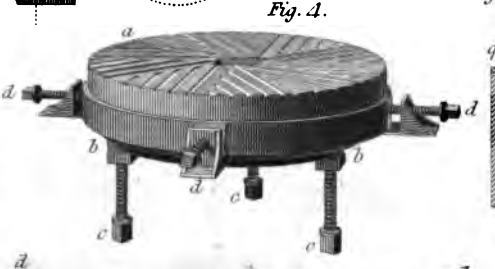
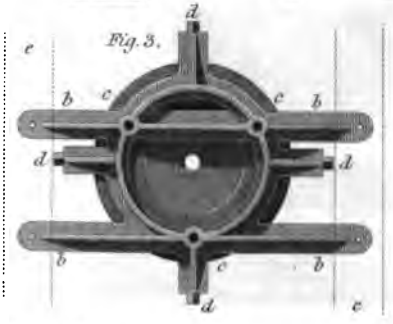
Mr. Thos. Austen's method of laying and adjusting the Bed Stone of a Corn-Mill.

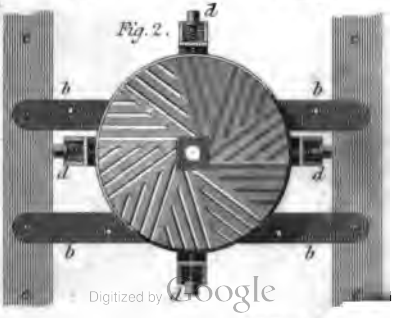












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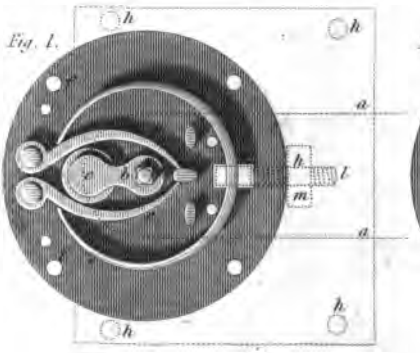
Mr. I. Whites, double Door Spring.

Pl. 2

Fig. 1.



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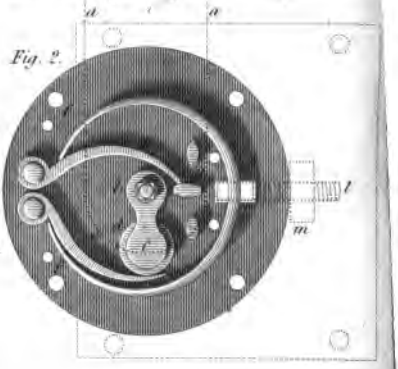

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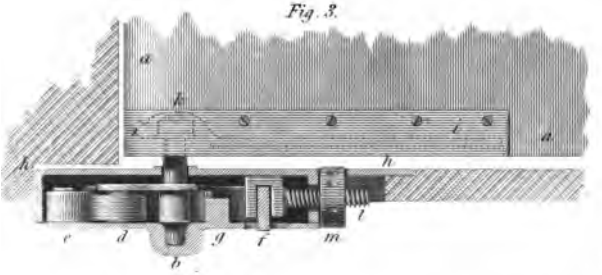


Mr. Smiths, Umbrella joint.

Fig. 6.

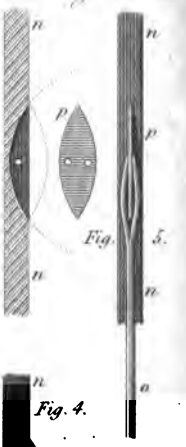


Fig. 5.

Mr. A. P. Harrisons, parellel Rule.

Fig. 7.

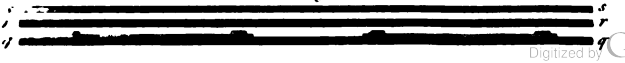
Fig. 10.

Fig. 9.

Fig. 4.

Fig. 11.

Fig. 8.



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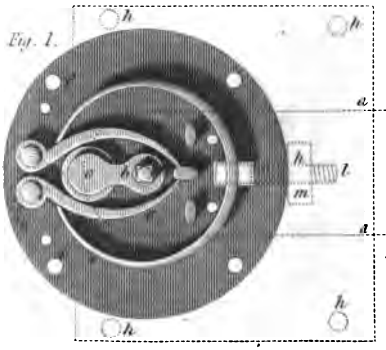
Mr. J. White's, double Door Spring.

Fig. 1.



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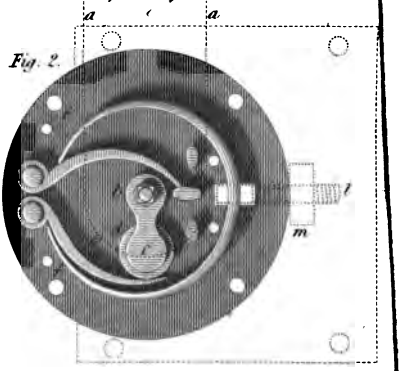

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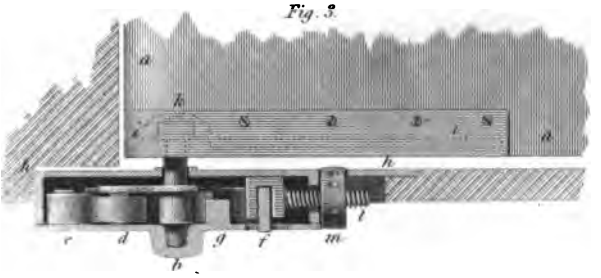


Mr. Smith's, Umbrella joint.

Fig. 6.

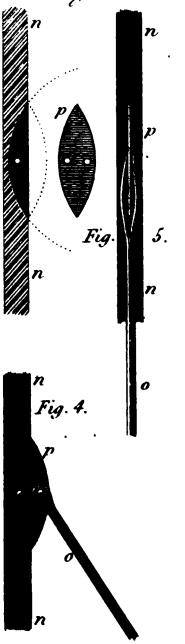


Fig. 5.

Fig. 4.

Mr. A. P. Harrison's, parellel Rule.

Fig. 7.

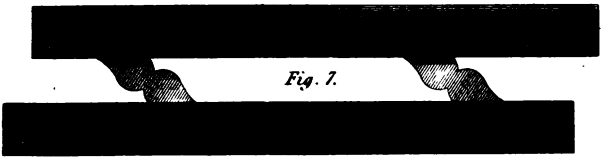
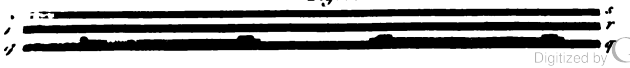


Fig. 10.

Fig. 9.

Fig. 11.

Fig. 8.



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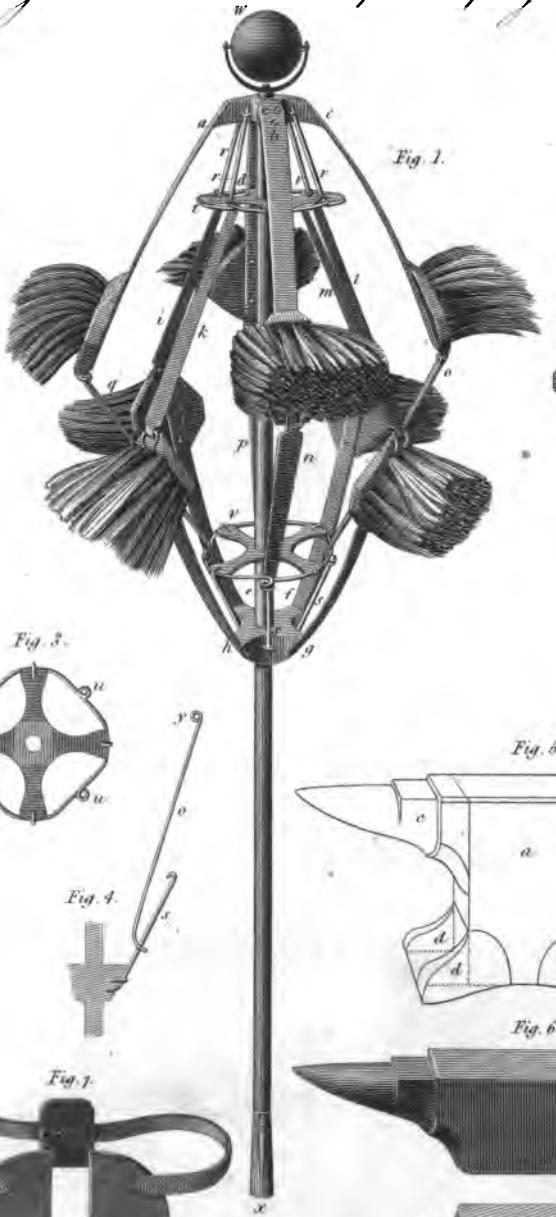
Mr. J. Skinner's Machine for sweeping Chimnies.



Mr. J. Gormans Spring Bandage.

Mr. R. Kings Anve

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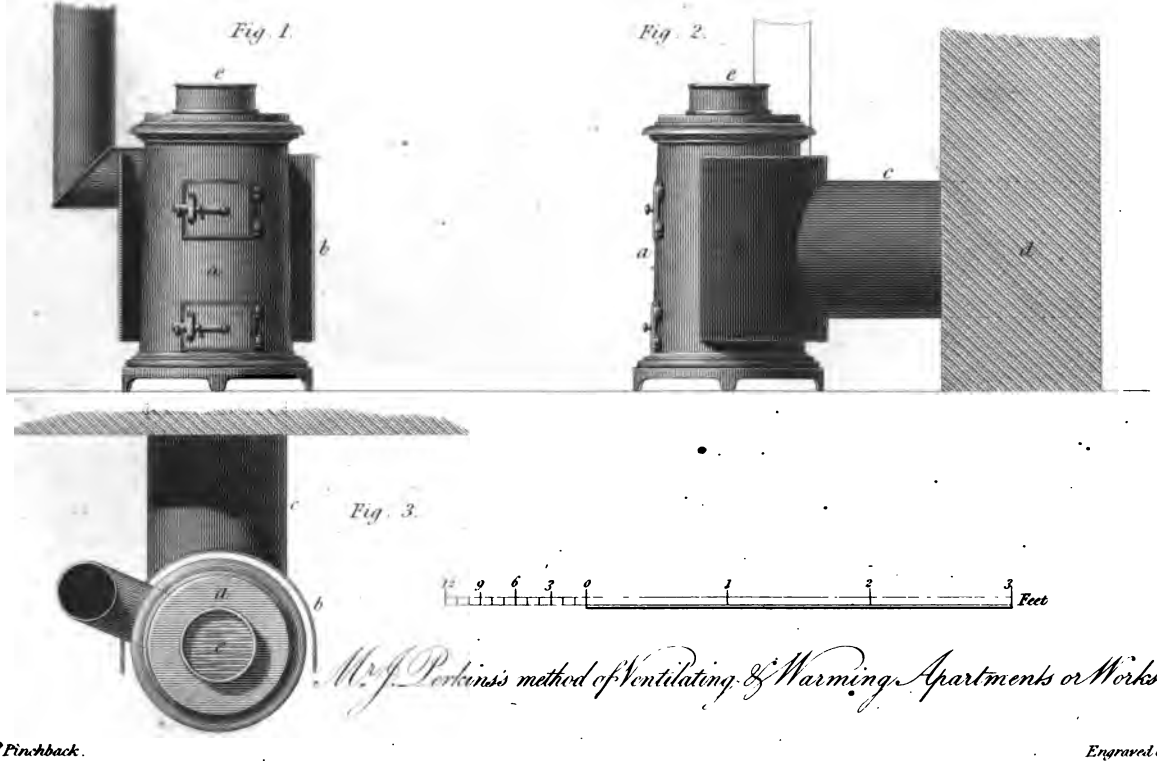

Mr. J. Perkins's method of Ventilating & Warming Apartments or Workshops.

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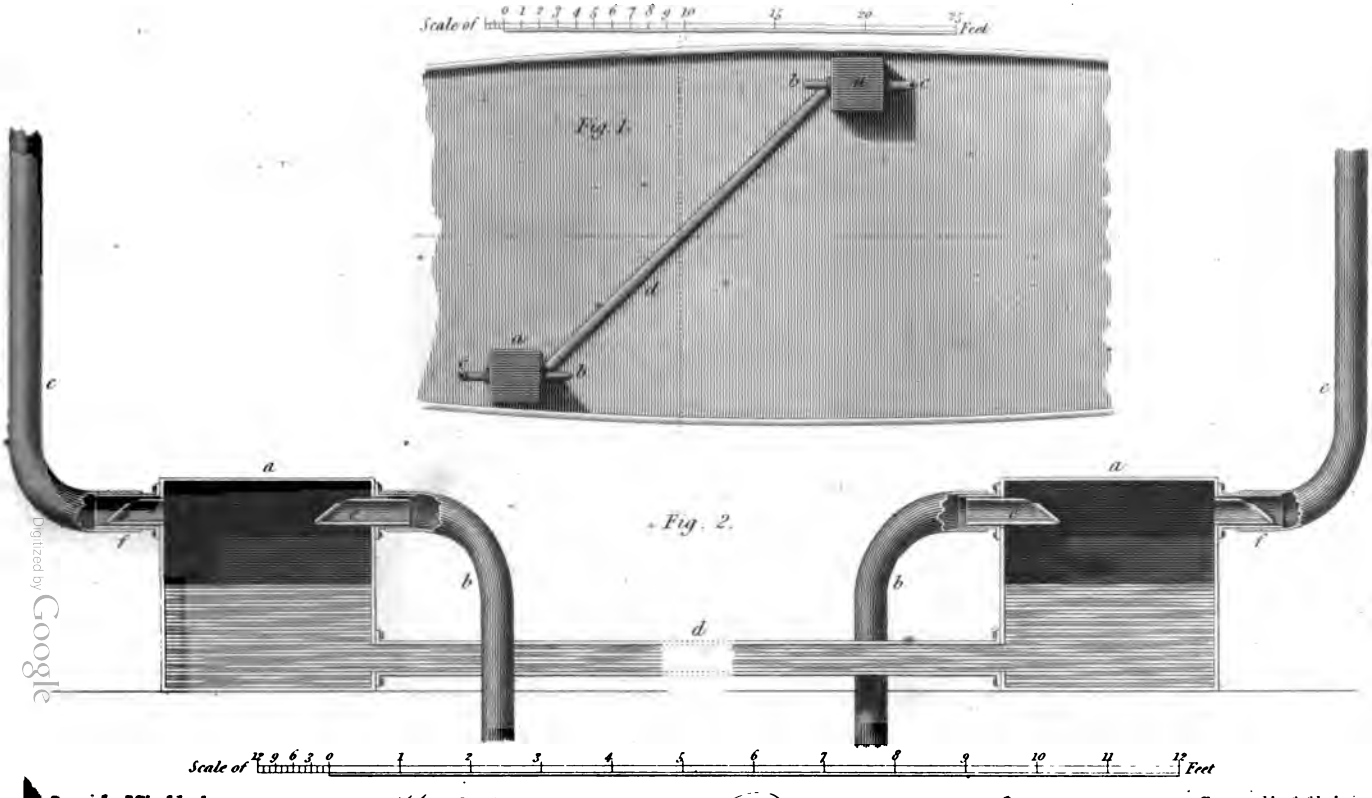

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Mr. Topling's method of c

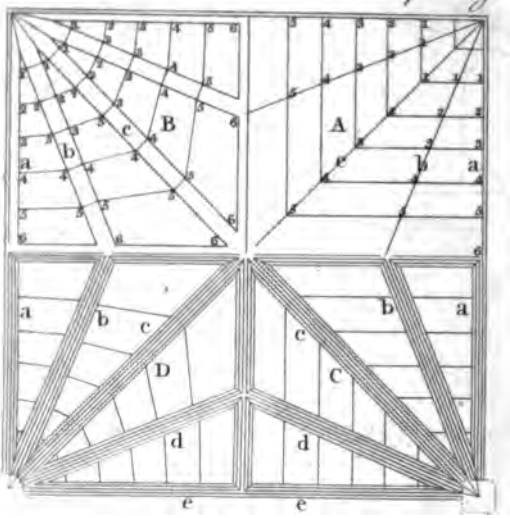

Fig. 1.

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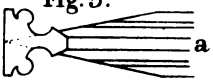

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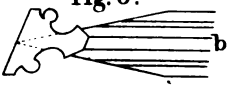

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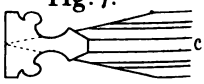

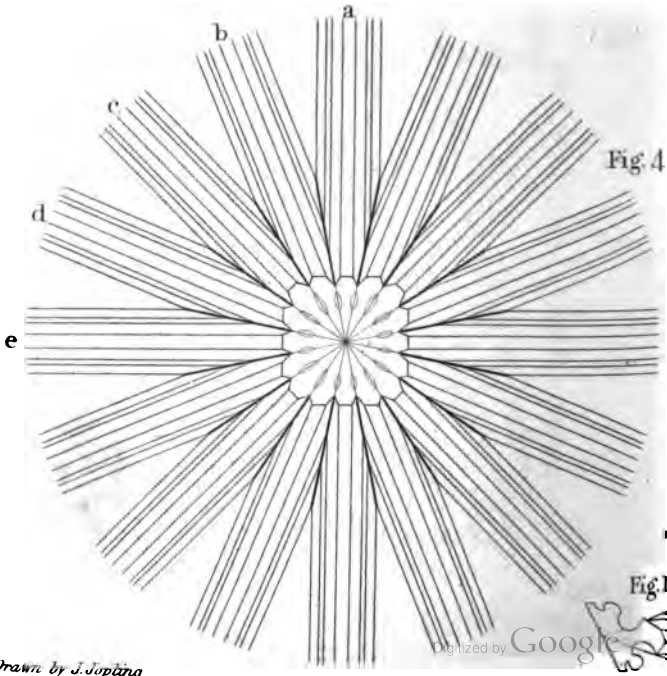

Fig. 4.

Fig. 10.

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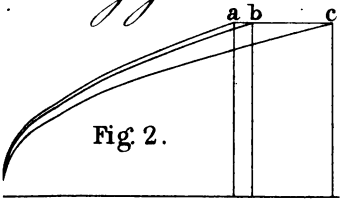

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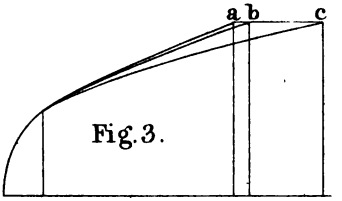

Fig. 3.

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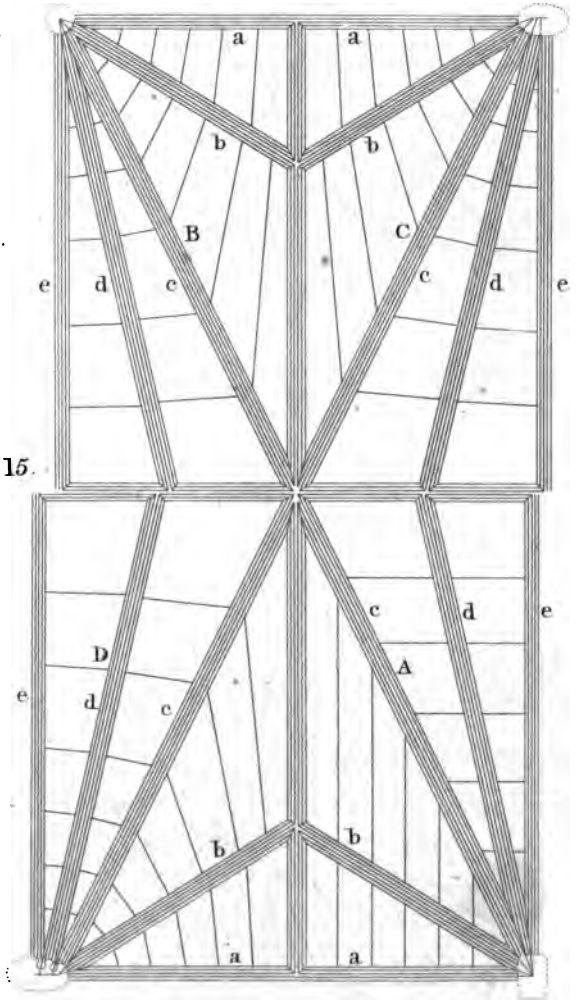

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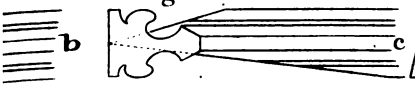

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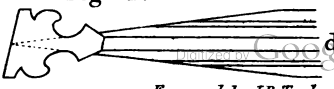

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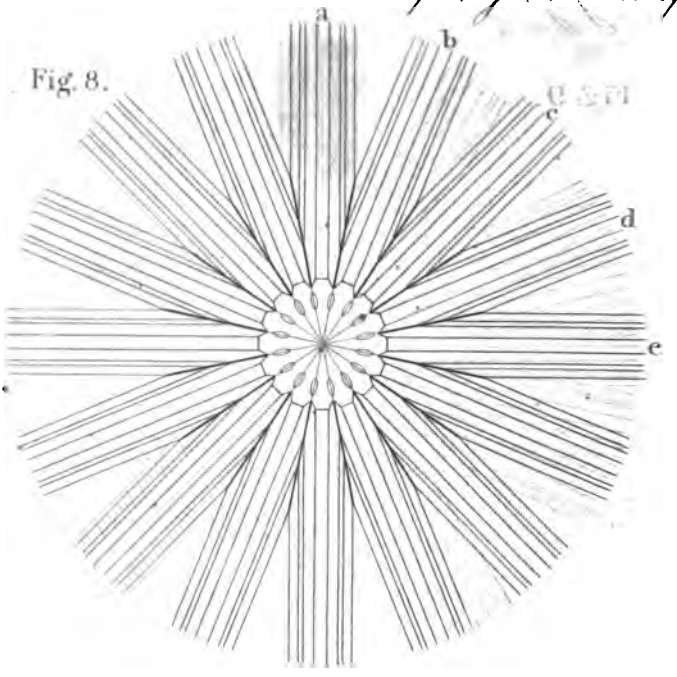
Mr. Topling's method of c

Fig. 8.



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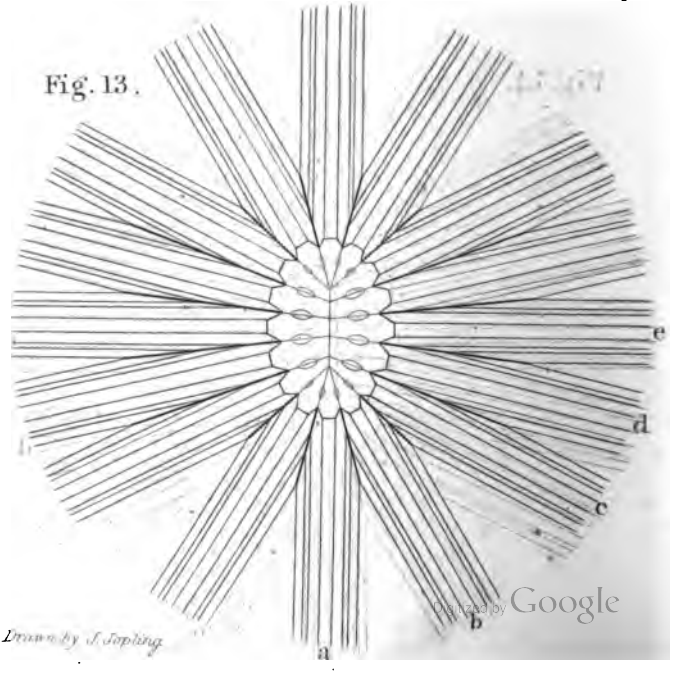

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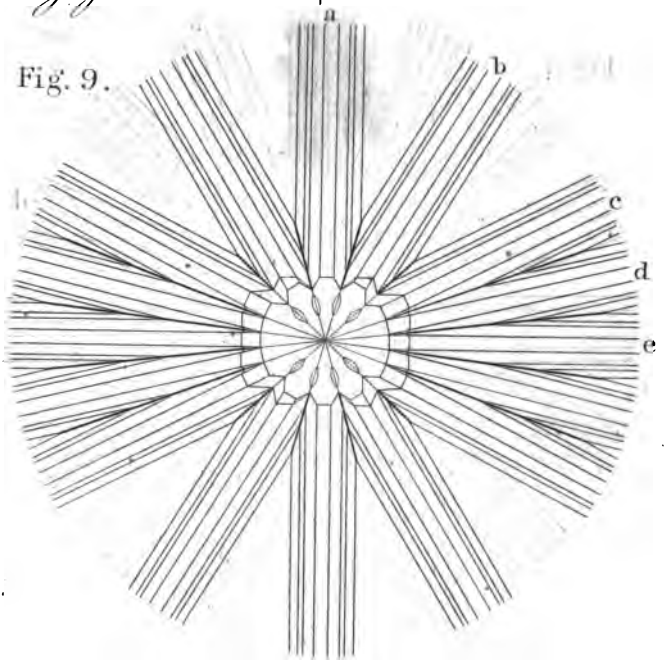
Straiding groined Arches. Pl. 10

Fig. 9.



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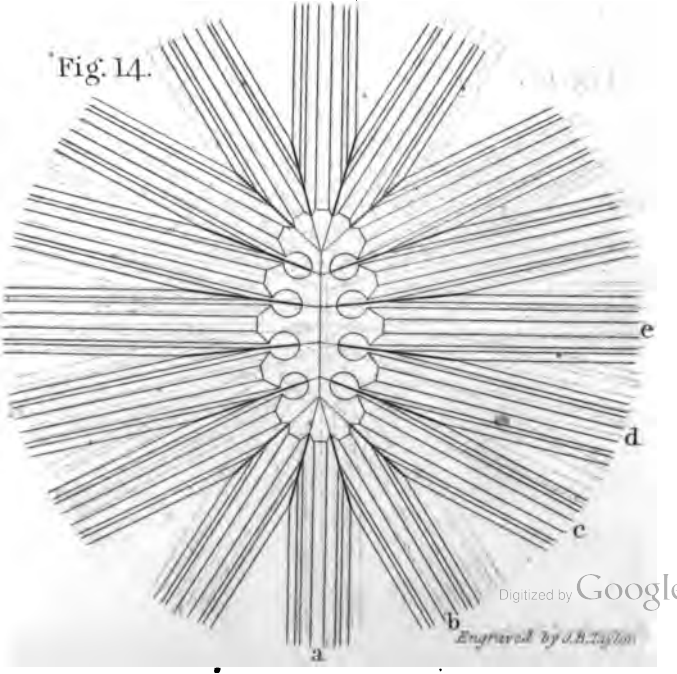

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Messrs Jeffries and Halley's Blowing Machine.

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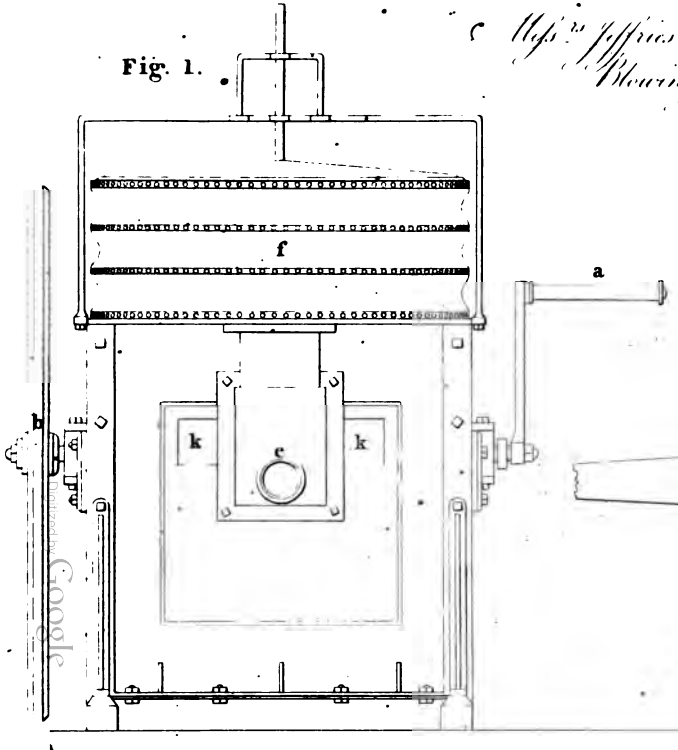

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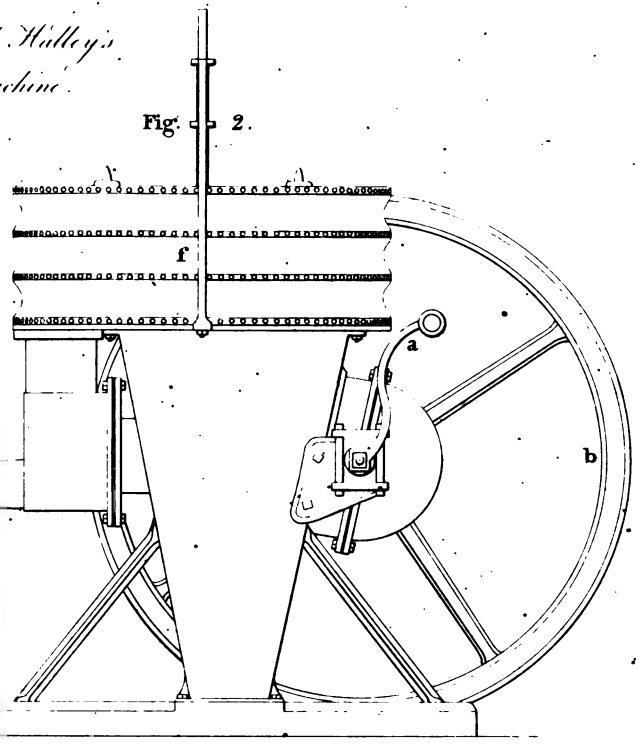

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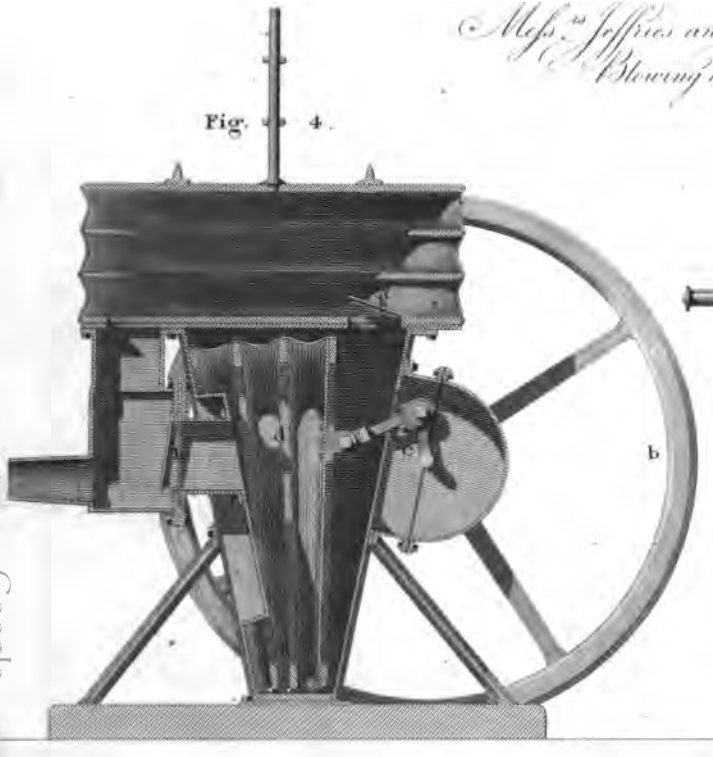
Mess.rs Jeffries and Halley's Blowing Machine.

Fig. 4.



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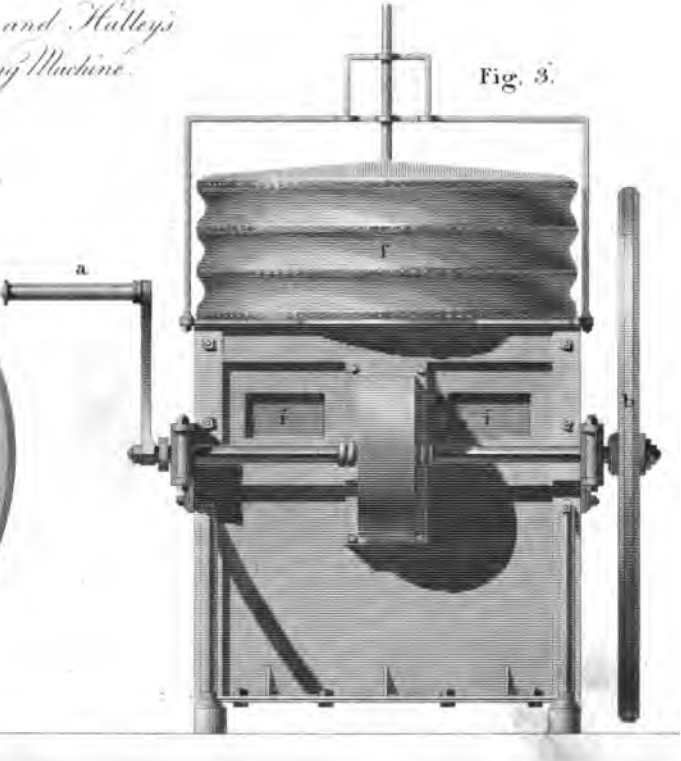

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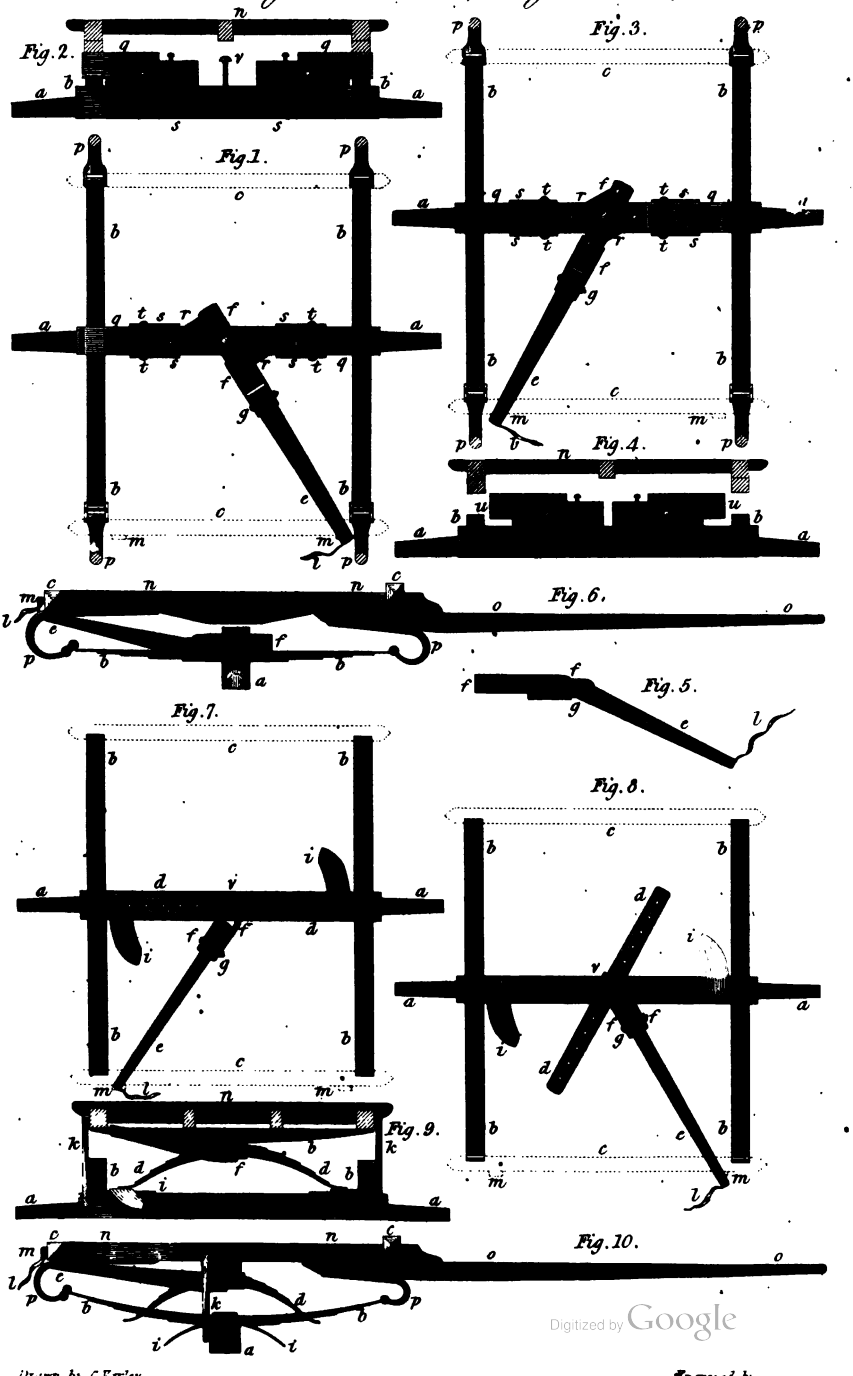
Mr. F. C. Cherry's moveable spring & blocks for carts. Pl.



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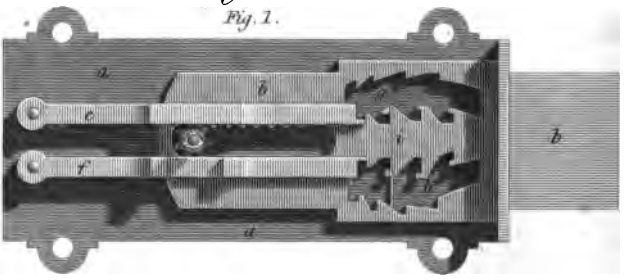
Mr. A. Ainger's Lock.

Pl. 14.

Fig. 5.

Fig. 6.

Fig. 1.



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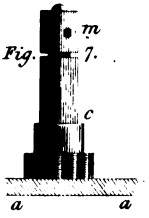

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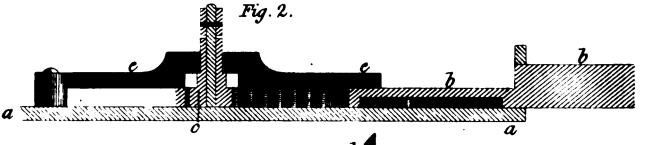
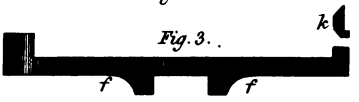


Fig. 3.



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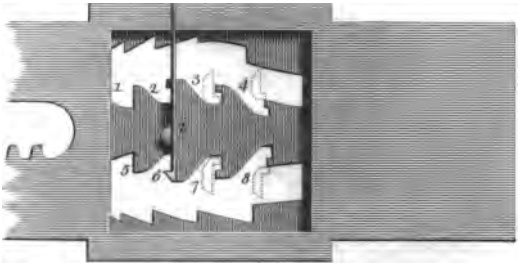
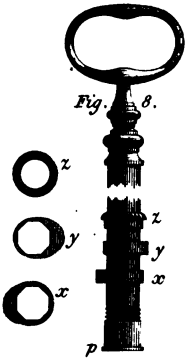


Fig. 9.

Fig. 8.



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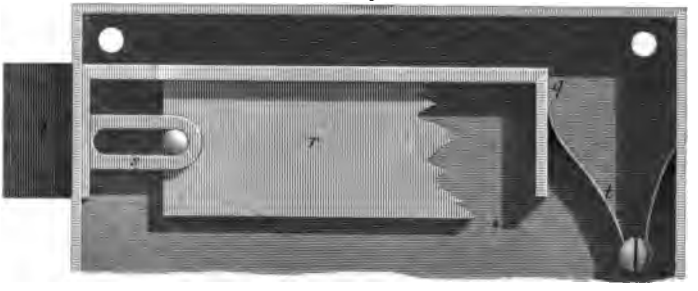

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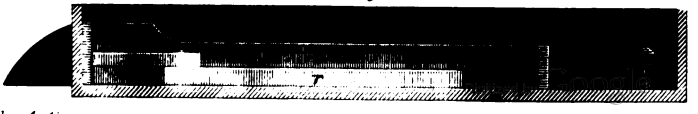

Drawn by A. Ainger.

Engraved by J.

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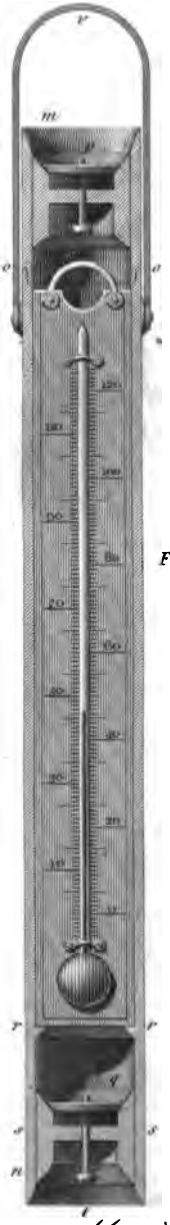
Mr. H. C. Jennings's Log Glass.



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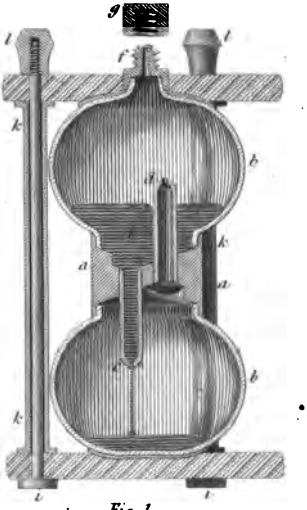

Fig. 1.

Fig. 5.

Fig. 2.

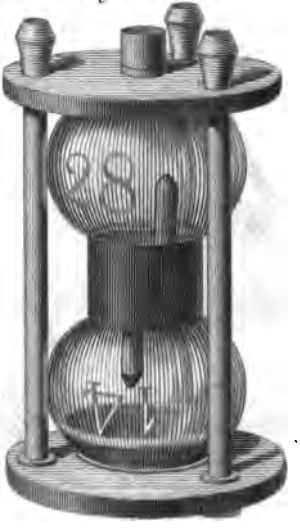

Fig. 4.

Mr. R. Jamieson's Marine Thermometer Case.

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Drawn by Cornelius Varley.

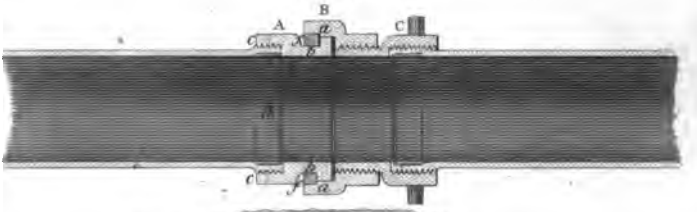
Engraved by G. G.

Digitized by Google

Mr. J. Perkins's Hose for Fire Engines.

Fig. 1.

Fig. 2.



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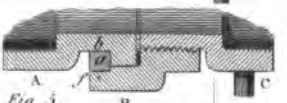
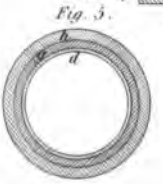


Fig. 4.

Fig. 5.



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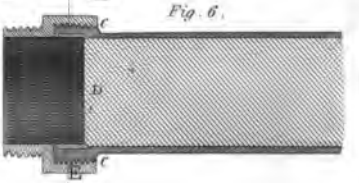

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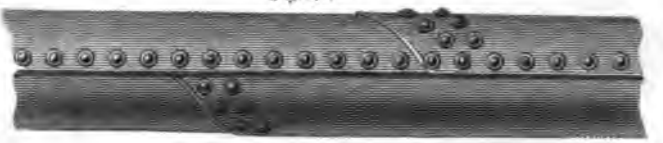

Fig. 8. Full Size.

Fig. 9.

Drawn by Pinchbeck. Engraved by J.H. Warren.

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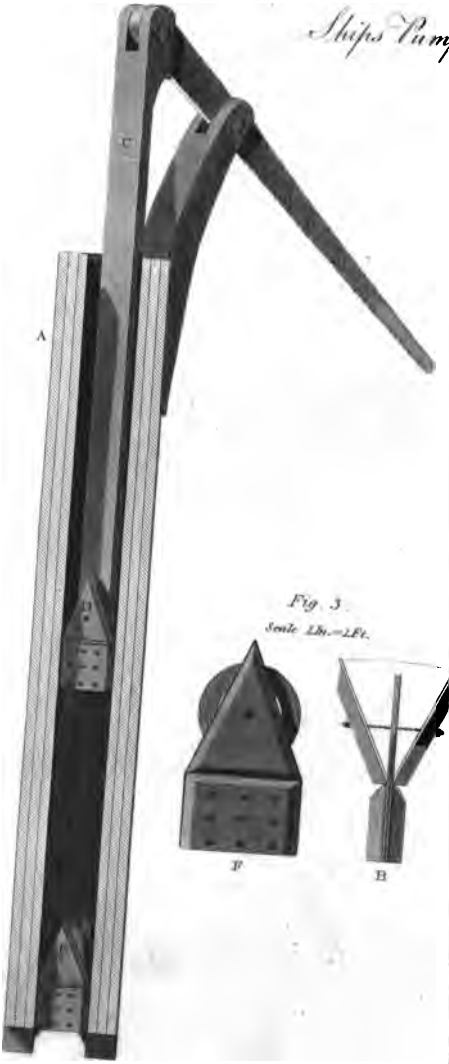
Mr. J. Perkins's
Ships Pump.

Fig. 1.



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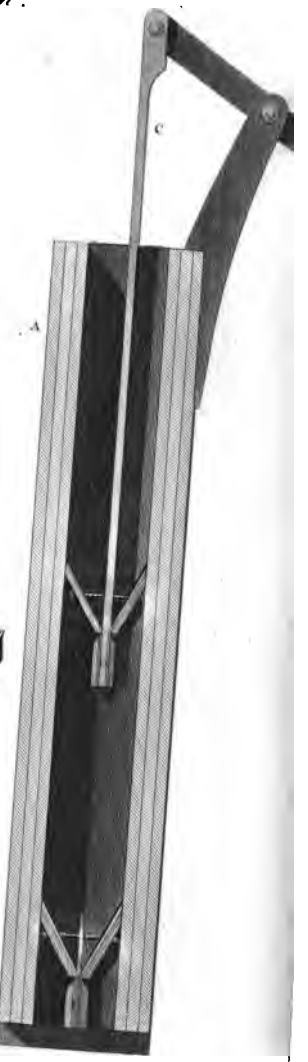
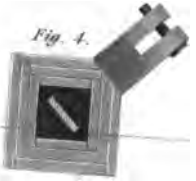


Fig. 3.
Scale 1 In. = 1 Ft.

Fig. 4.



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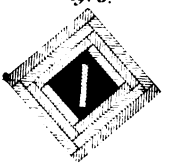

Drawn by Pinchbeck.

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Mr. R. Pe

Fig. 1.

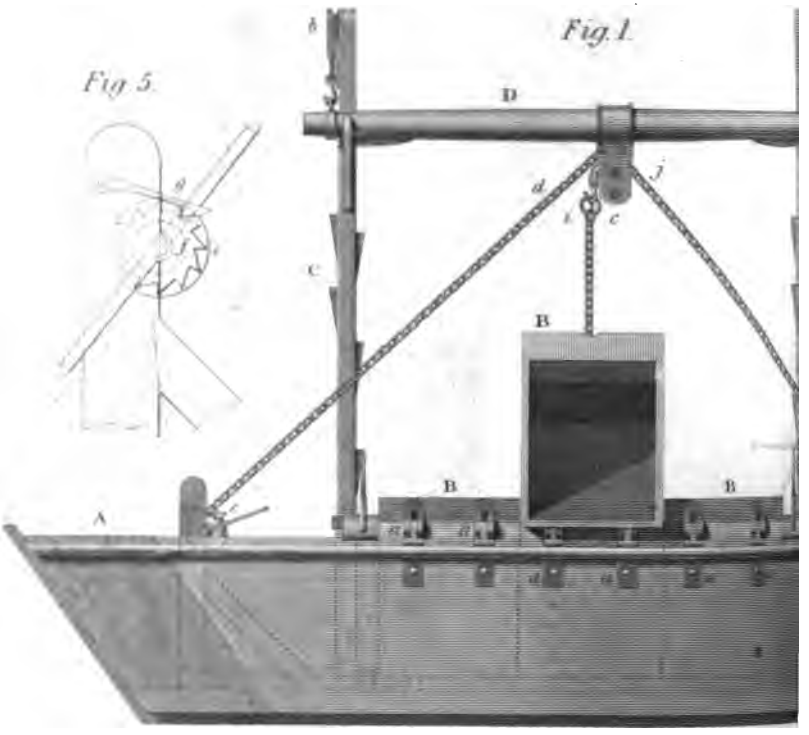

Fig. 5.

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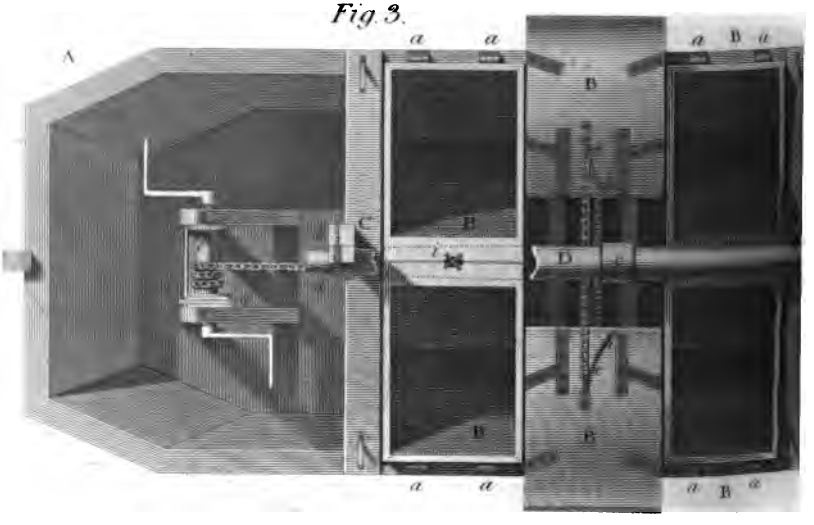
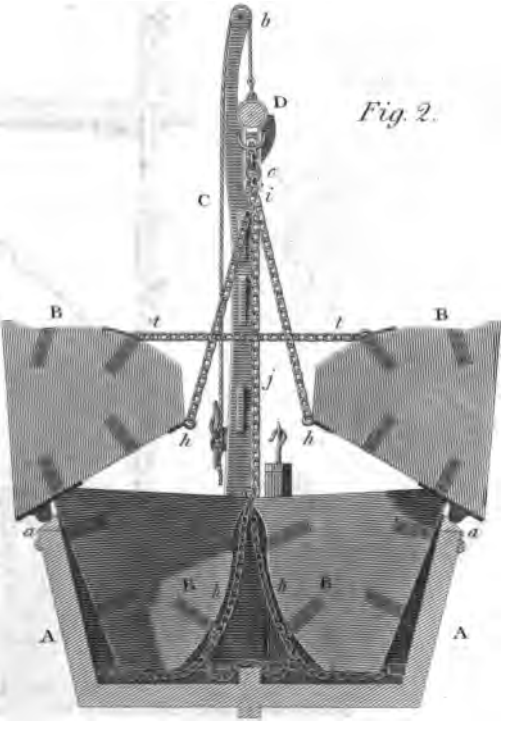


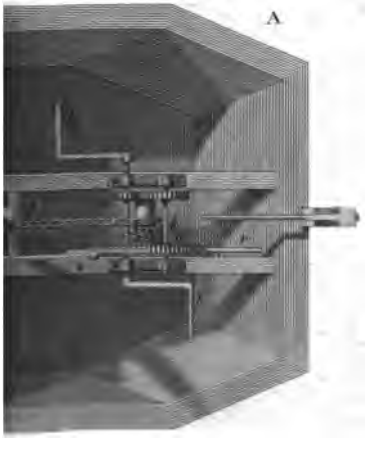
Drawn by J. Clement.

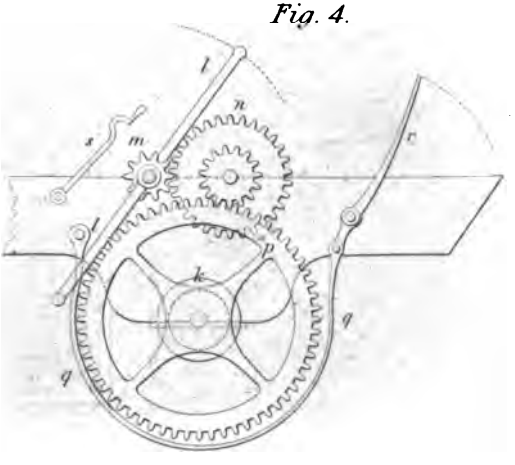
Digitized by Google

q's Mud-boat.

Plate XVIII.







Engraved by J. Davis

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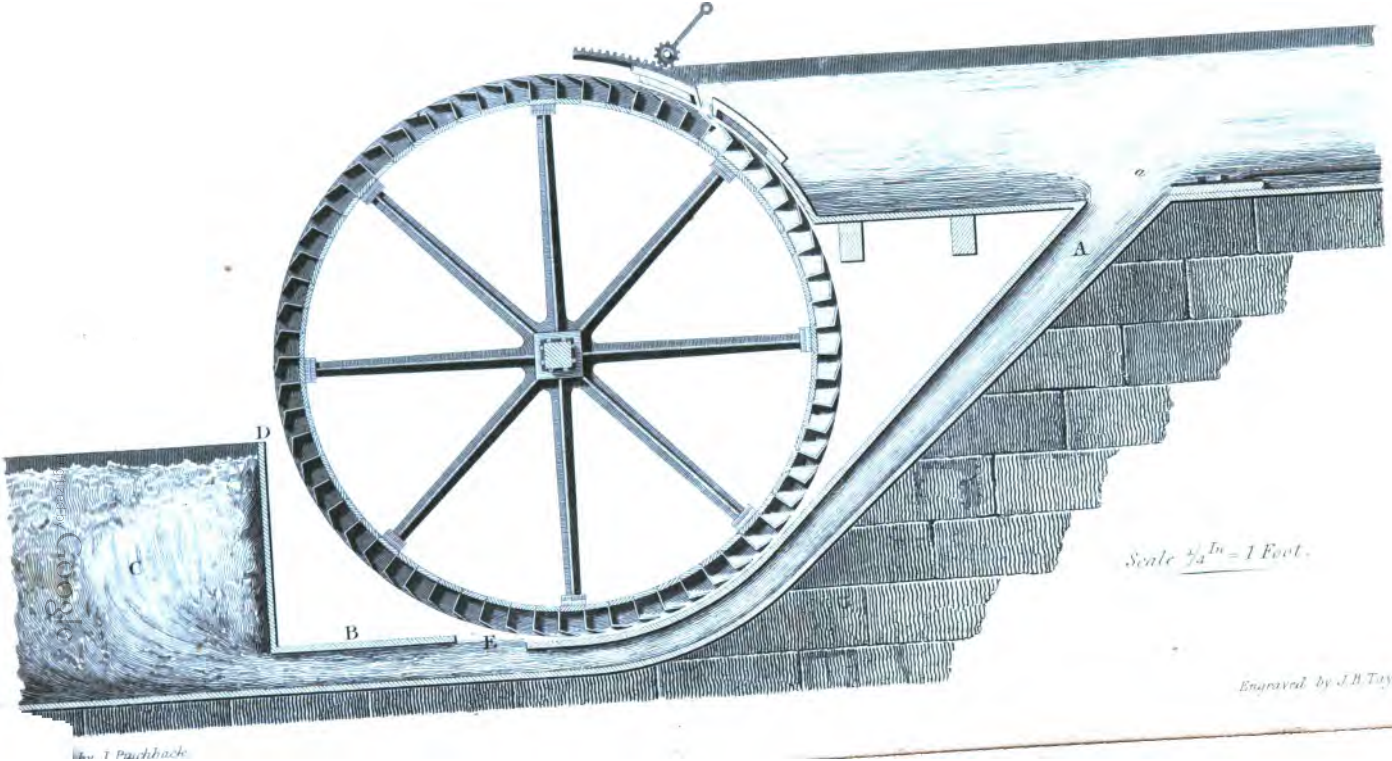
Mr. J. Perkins's method of freeing water-wheels from back-water. Pl. 19.



Drawn by T. Pinchbeck.

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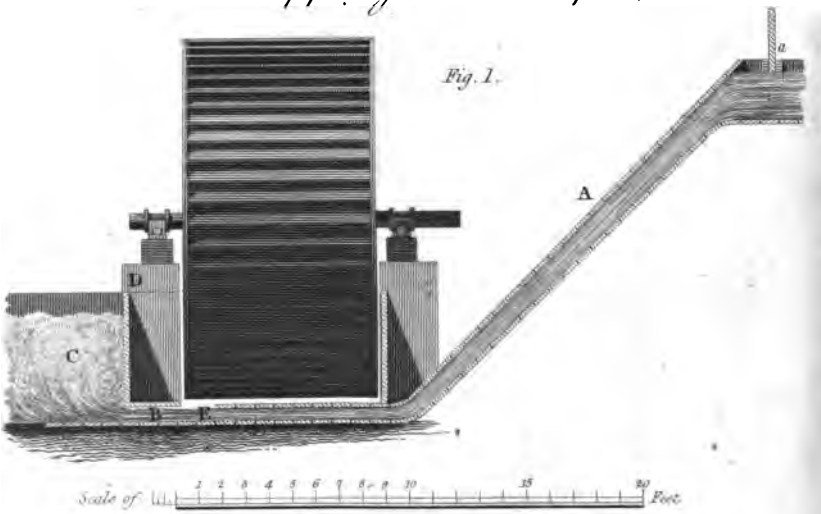
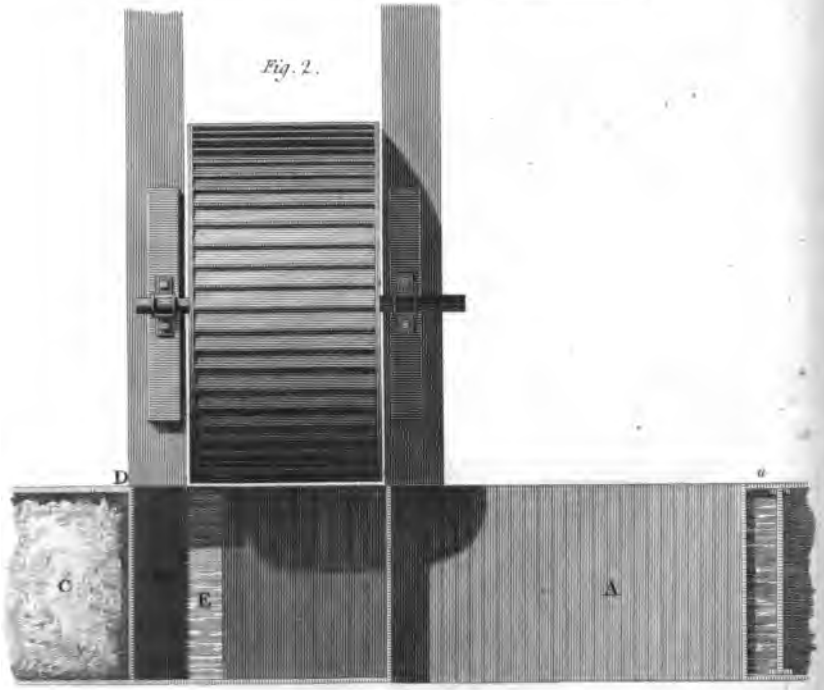
Mr. J. Perkins's method of freeing water-wheels from back-water.





Drawn by J. Peckham.

Engraved by J. B. Taylor.

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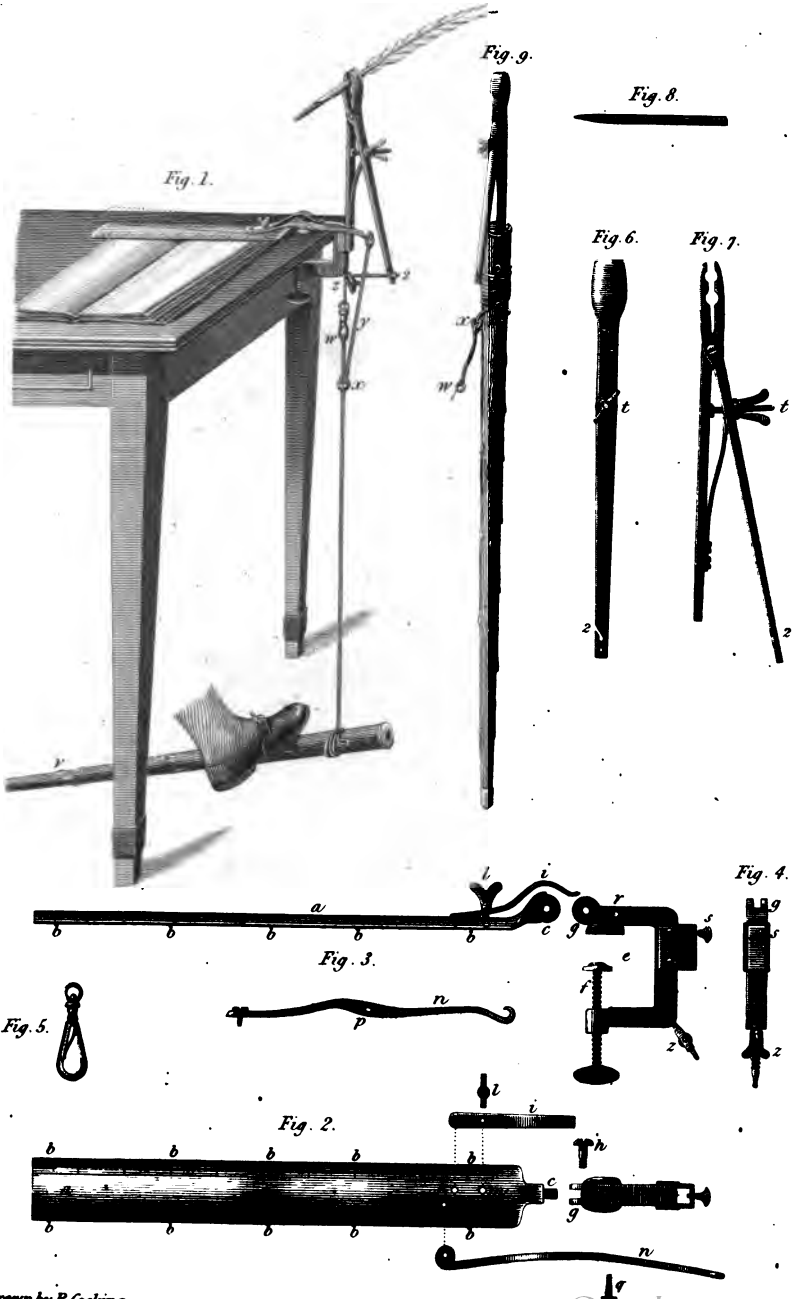
Capt.n G. F. Stack's Apparatus for those who have lost an Ar



Drawn by R. Cocking.

Engraved by G.

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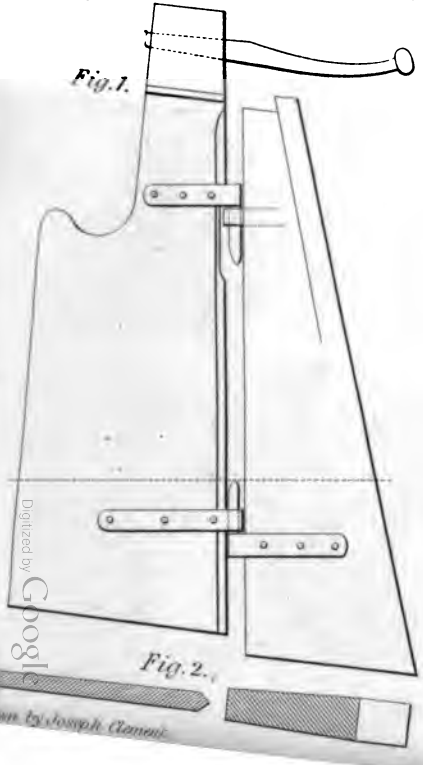
Wm. Hookey's Improved Boat Rudder.

Pl. 22.



Drawn by Joseph Clement

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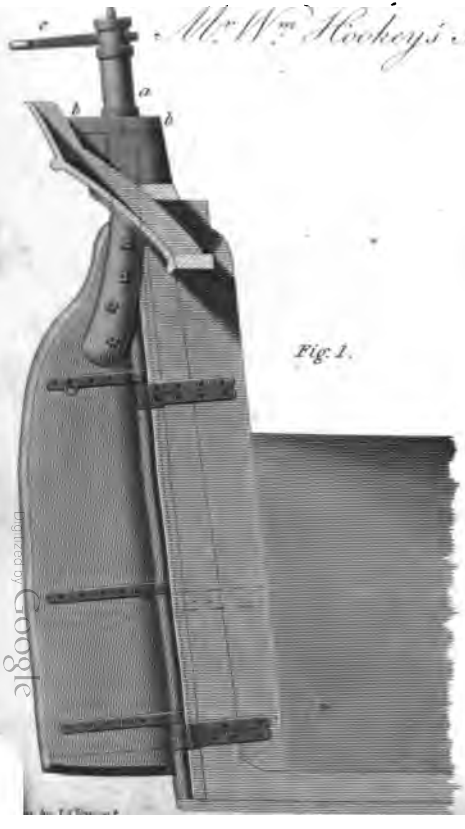
Mr. Wm. Hookey's Improved Rudder for Merchant Ships.



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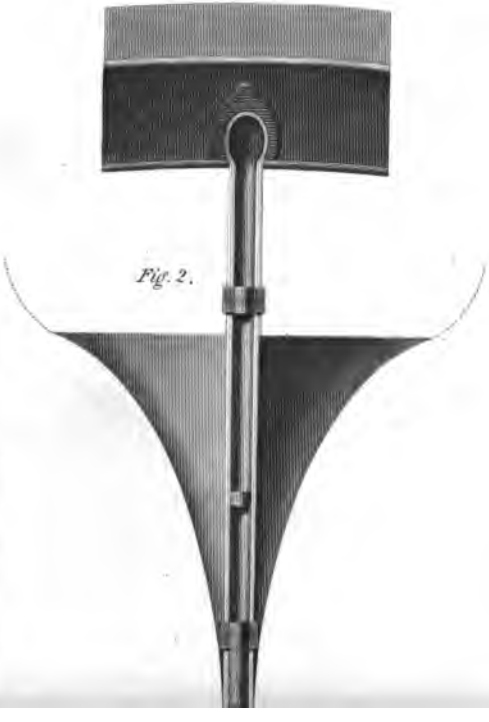

Fig. 2.

Fig. 3.

Fig. 4.

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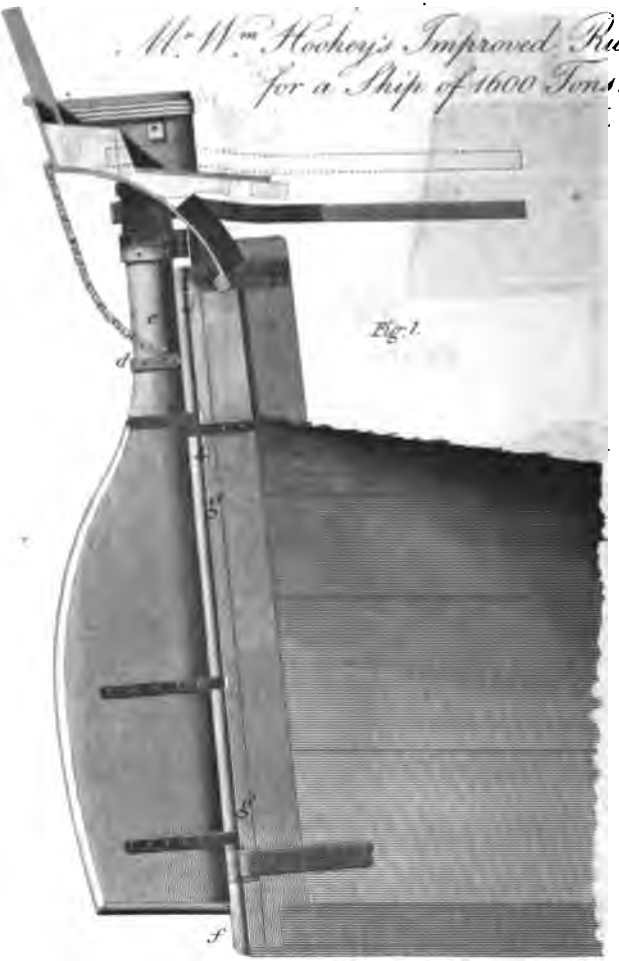
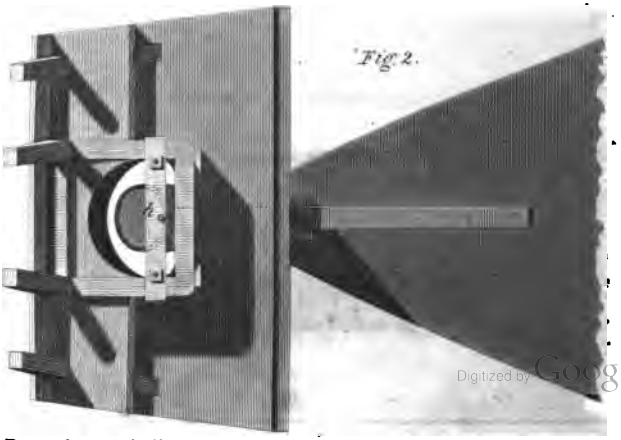
Mr. Wm. Hookey's Improved Rudder for a Ship of 1600 Tons.





Drawn by Joseph Clement.

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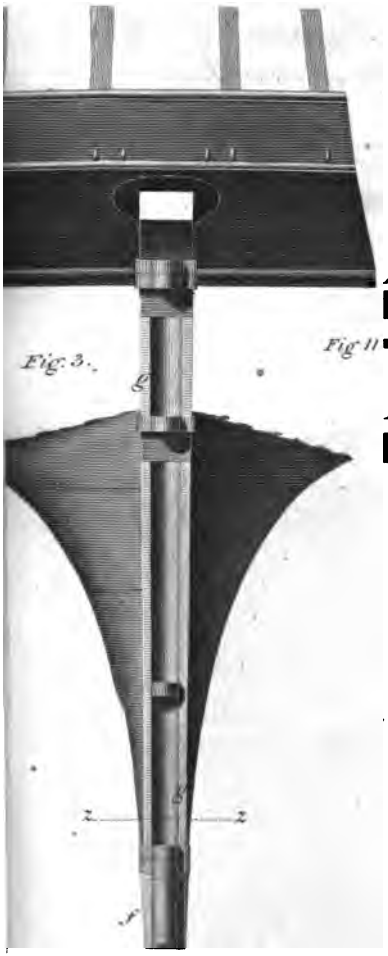

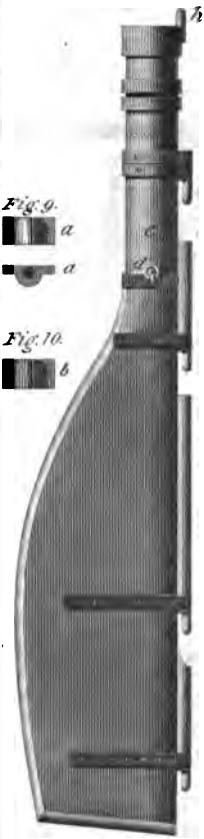

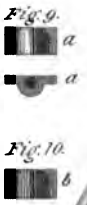

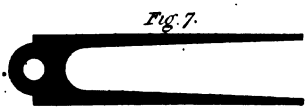

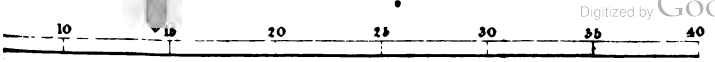

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Engraved by James Davis.

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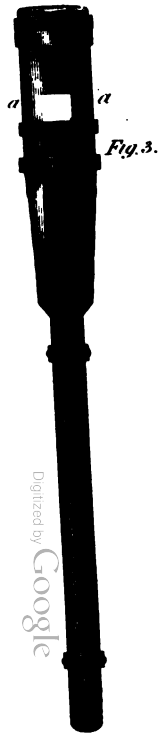
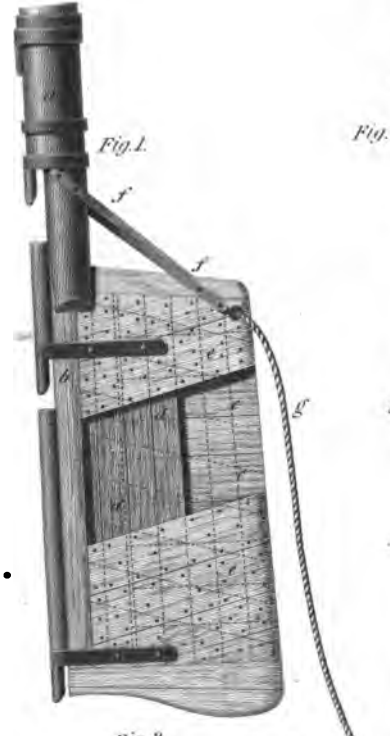
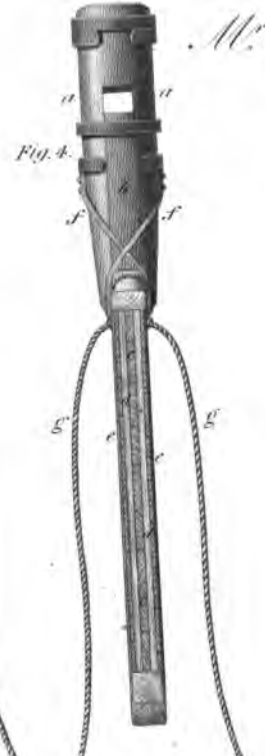
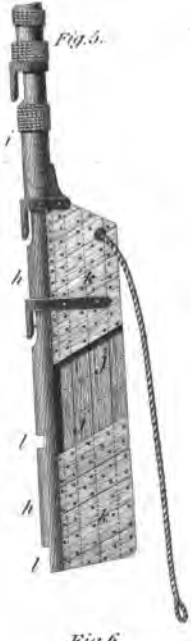
Mr. Wm. Hookey's Temporary Ships Rudders.









Engraved by James Davis

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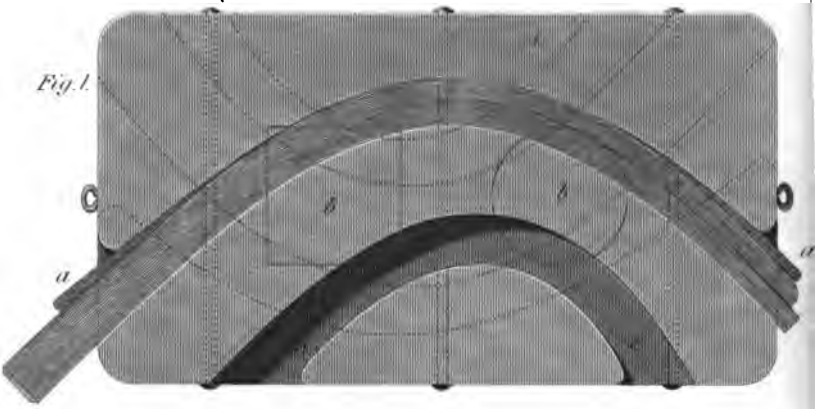
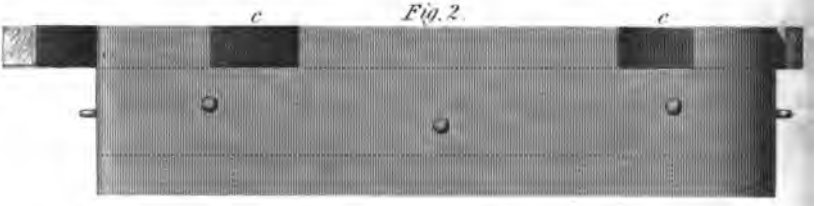
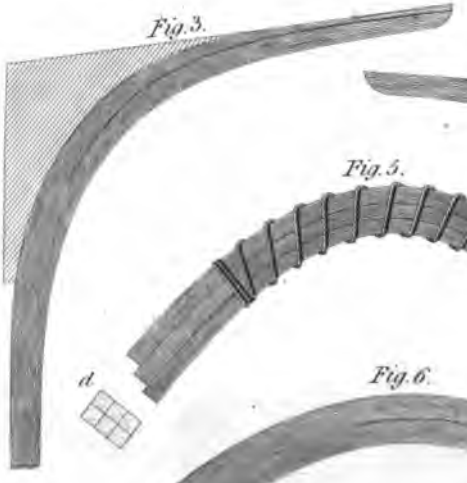
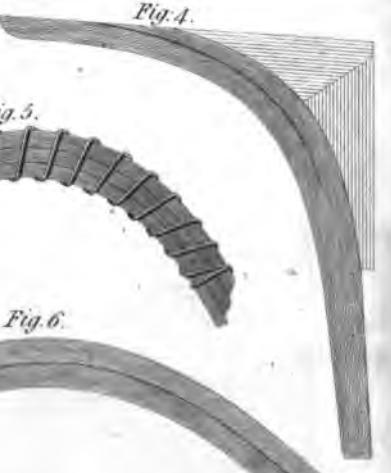
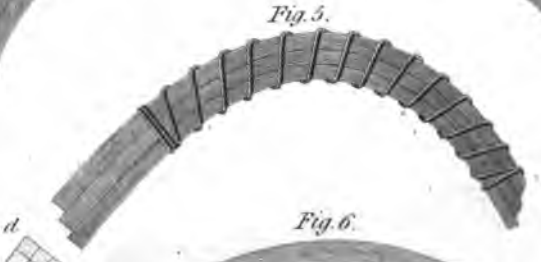
Mr. Wm. Hookey's Improved Boats Knees and Timbers











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Drawn by Joseph Clement. Engraved by James

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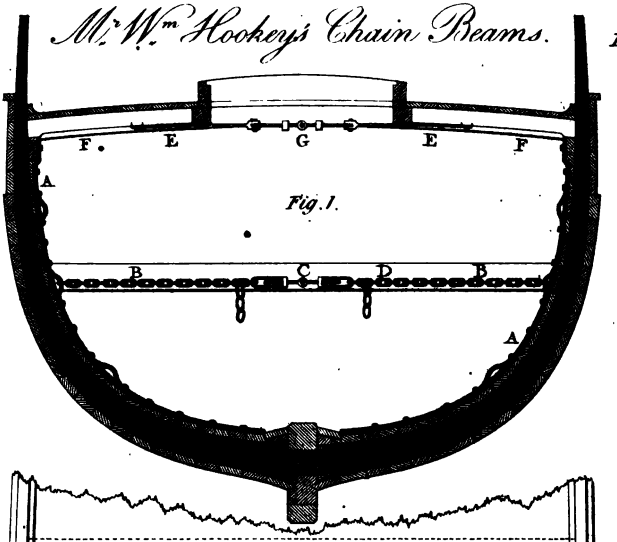
Mr. Wm. Hookey's Chain Beams.



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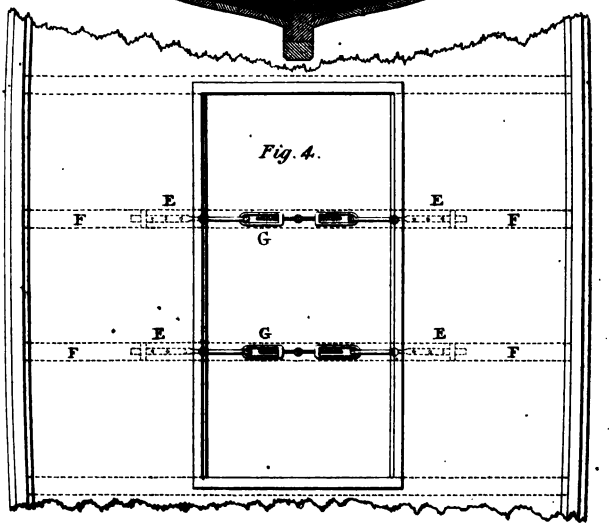

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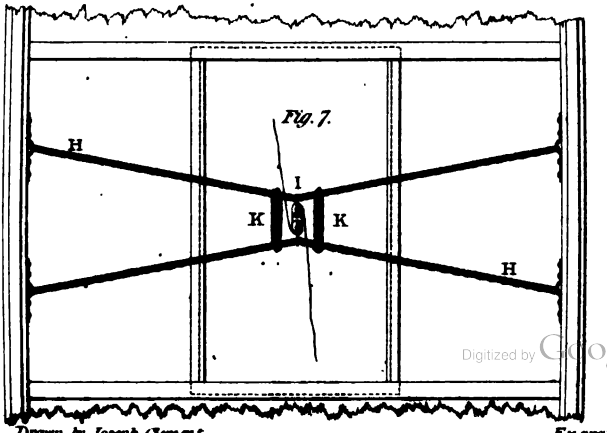

Fig. 7.

Fig. 2.

Fig. 3.

Fig. 6.

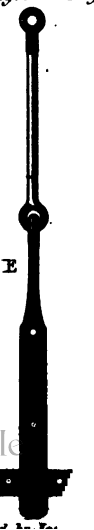

Fig. 6.

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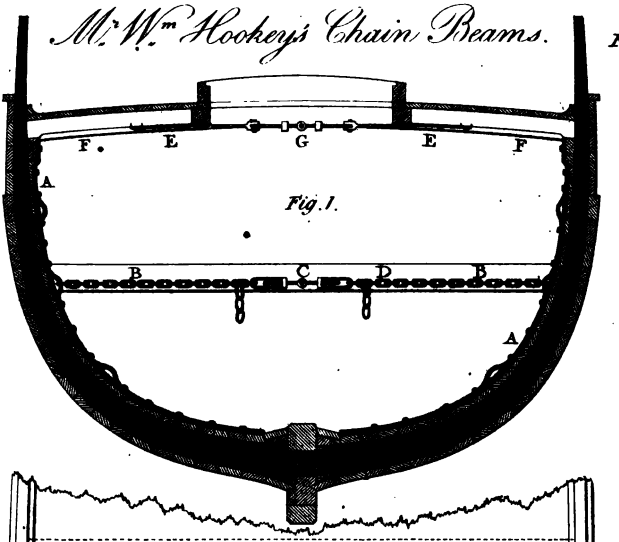
Mr. Wm. Hockey's Chain Beams.



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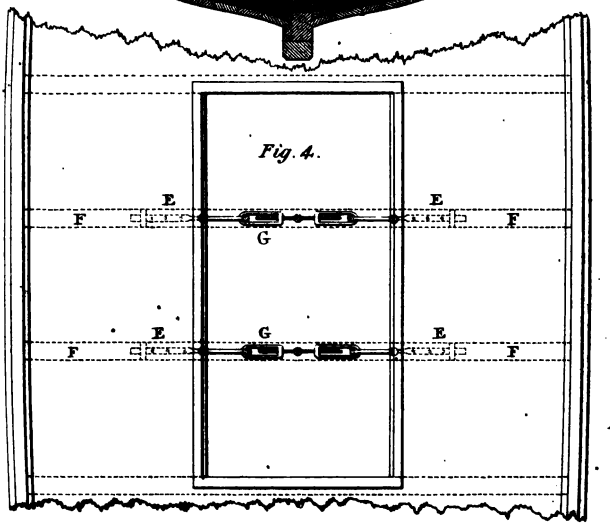

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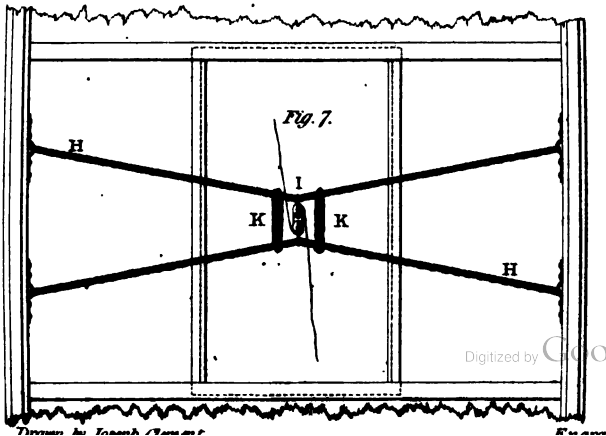

Fig. 7.

Fig. 2.

Fig. 3.

Fig. 5.

Fig. 6.

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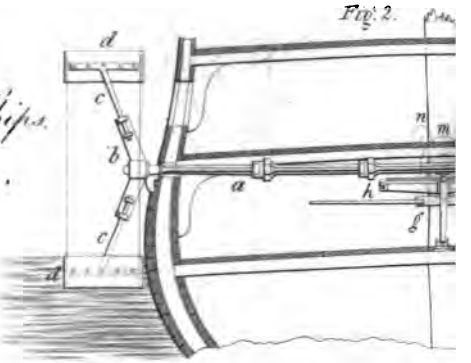
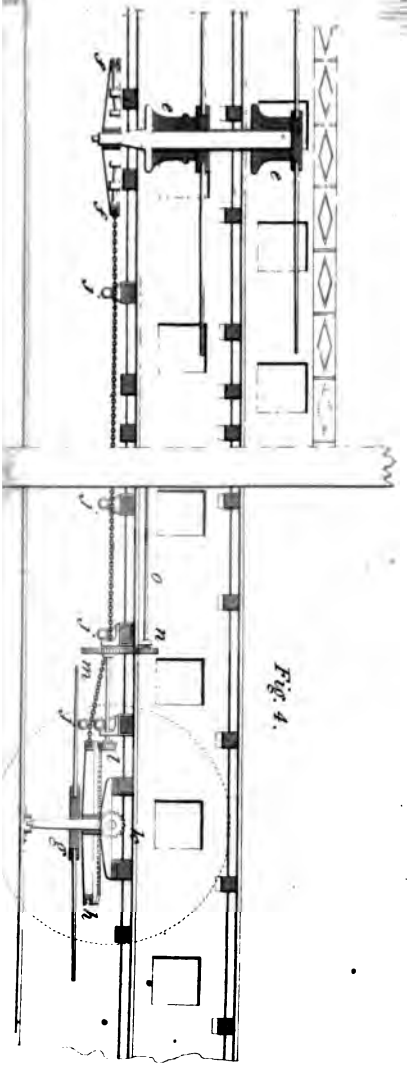
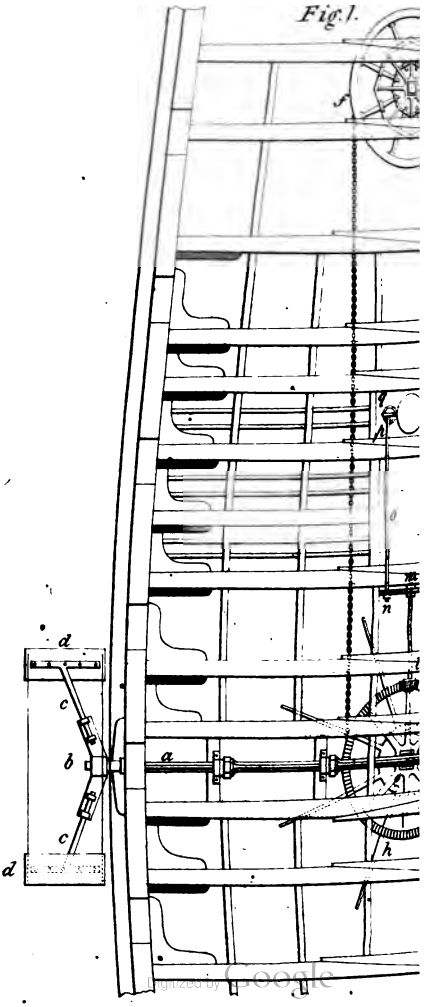
Method of Propelling Ships.
by Capt. James Burton.







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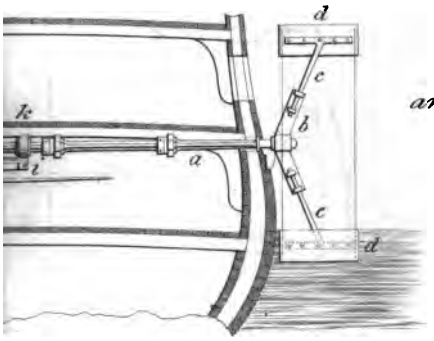
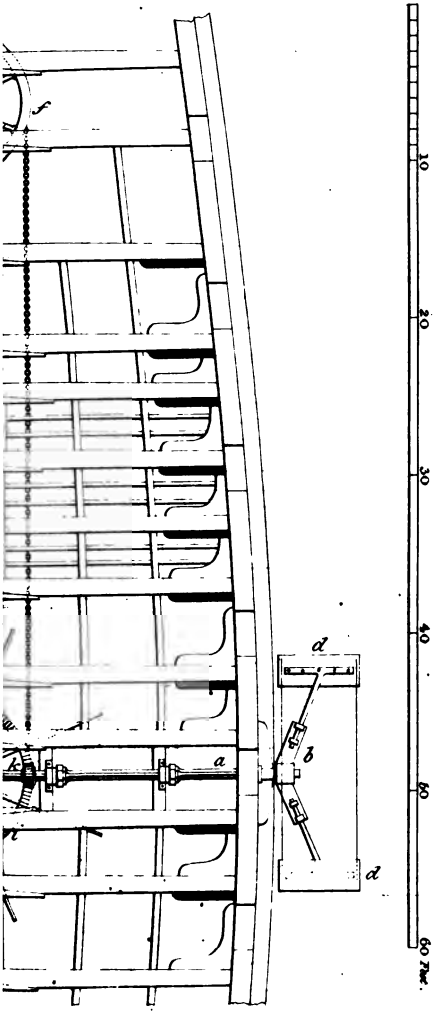
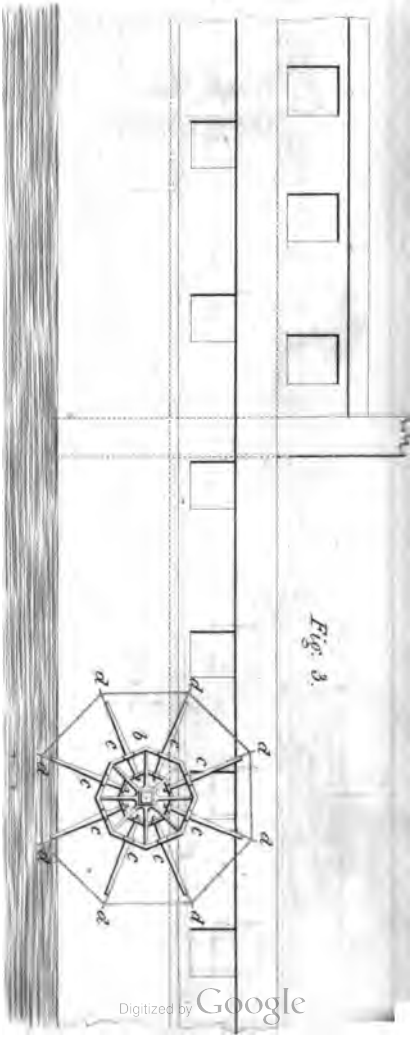


and Working the Pumps of the Royal Navy.





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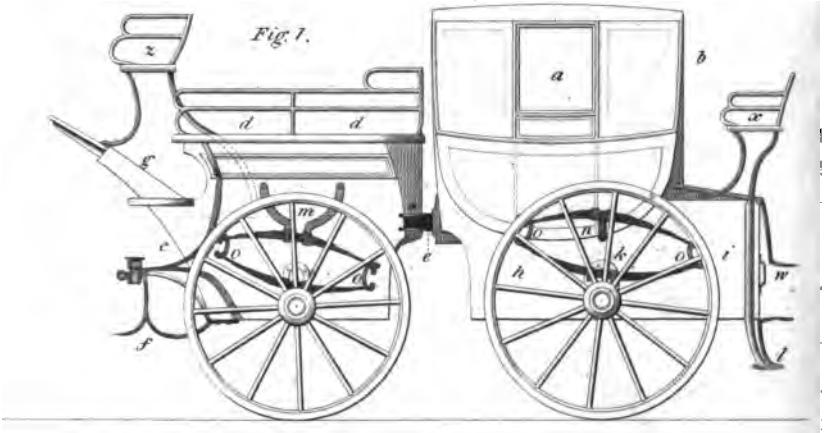
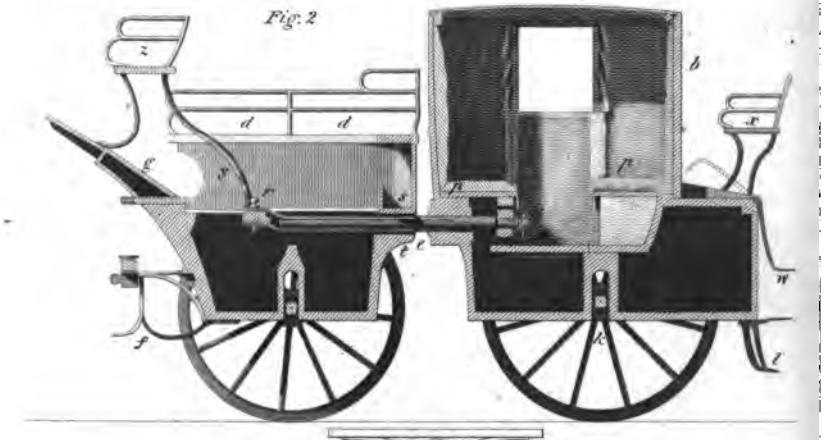
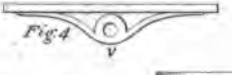
Mr. O Elliot's Safe Coach.







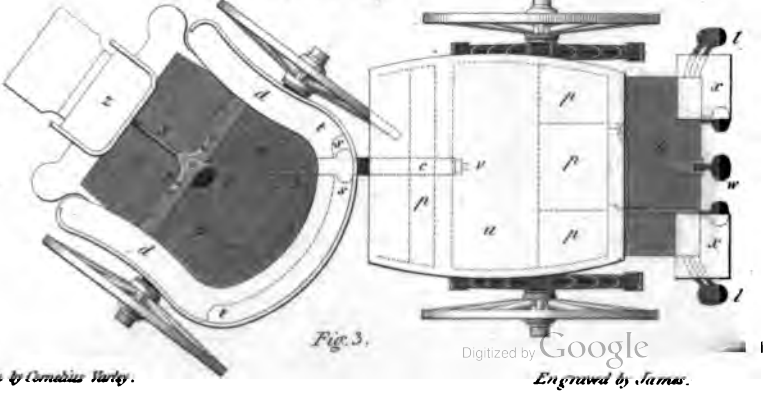


Fig. 3.

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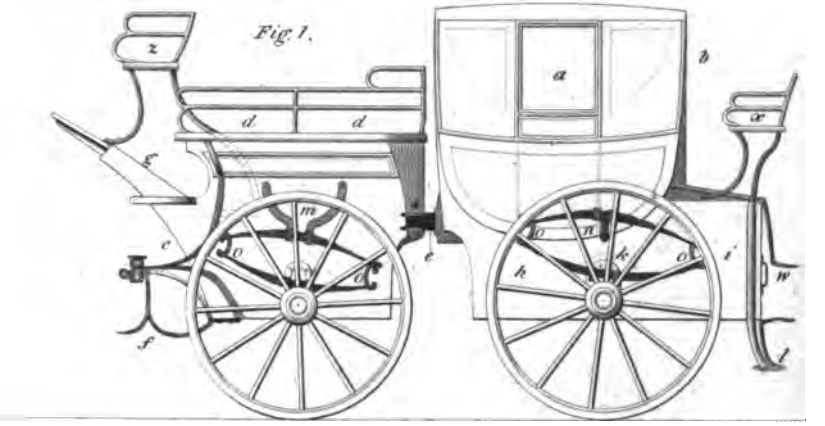
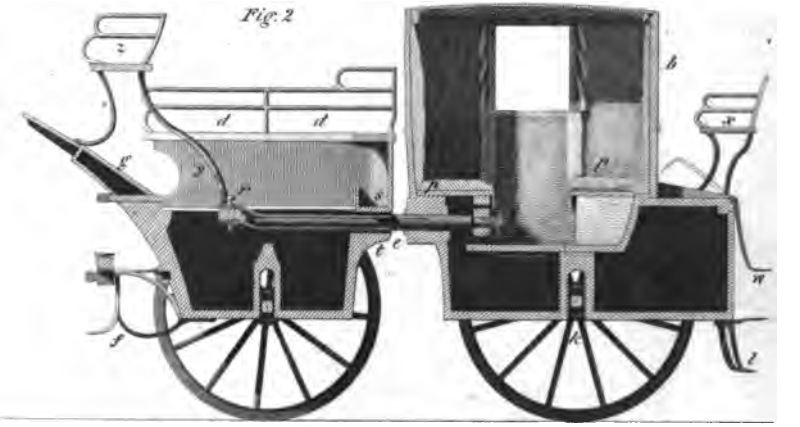
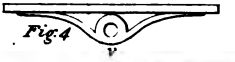
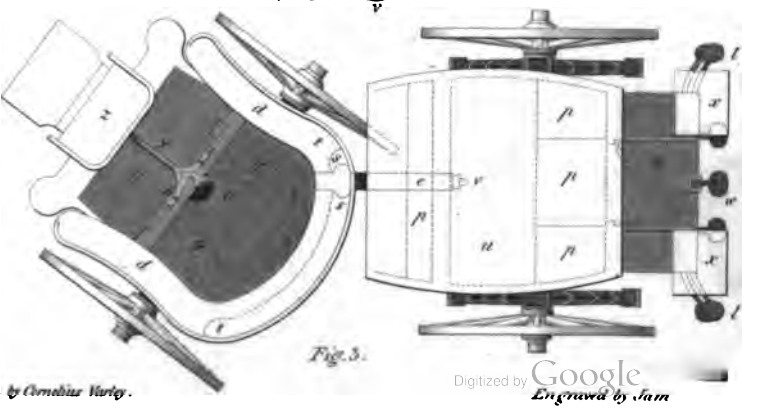
Mr. O Elliot's Safe Coach.









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Engraved by Sam

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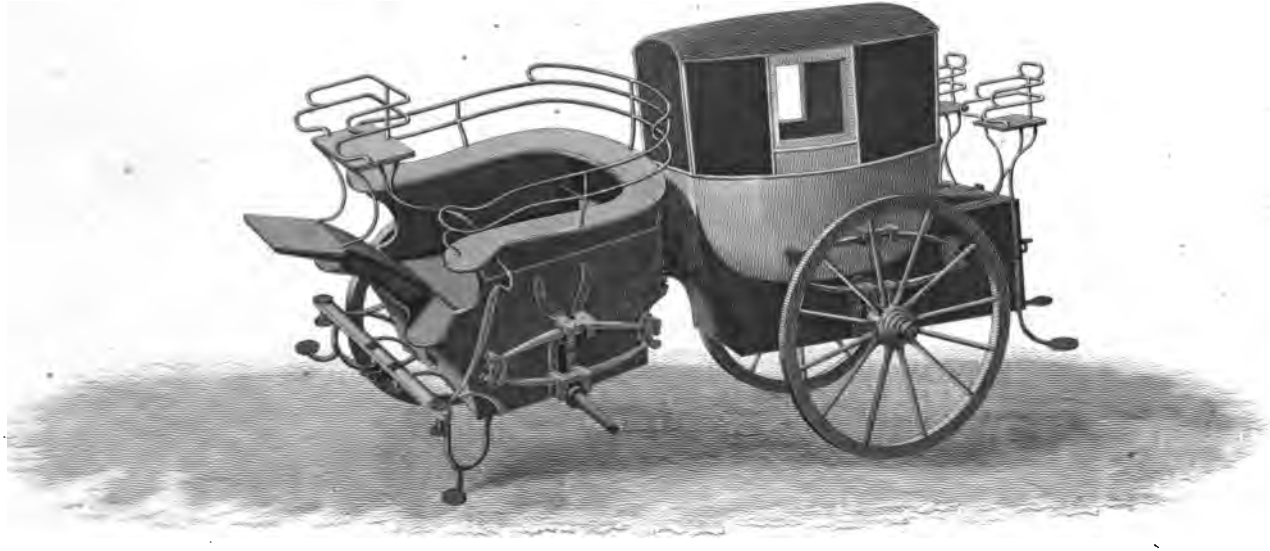
Mr O'Elliots Safe Coach.



Drawn by Cornelius Varley.

Engraved by James Davis.

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W. Newton del. et sculp.

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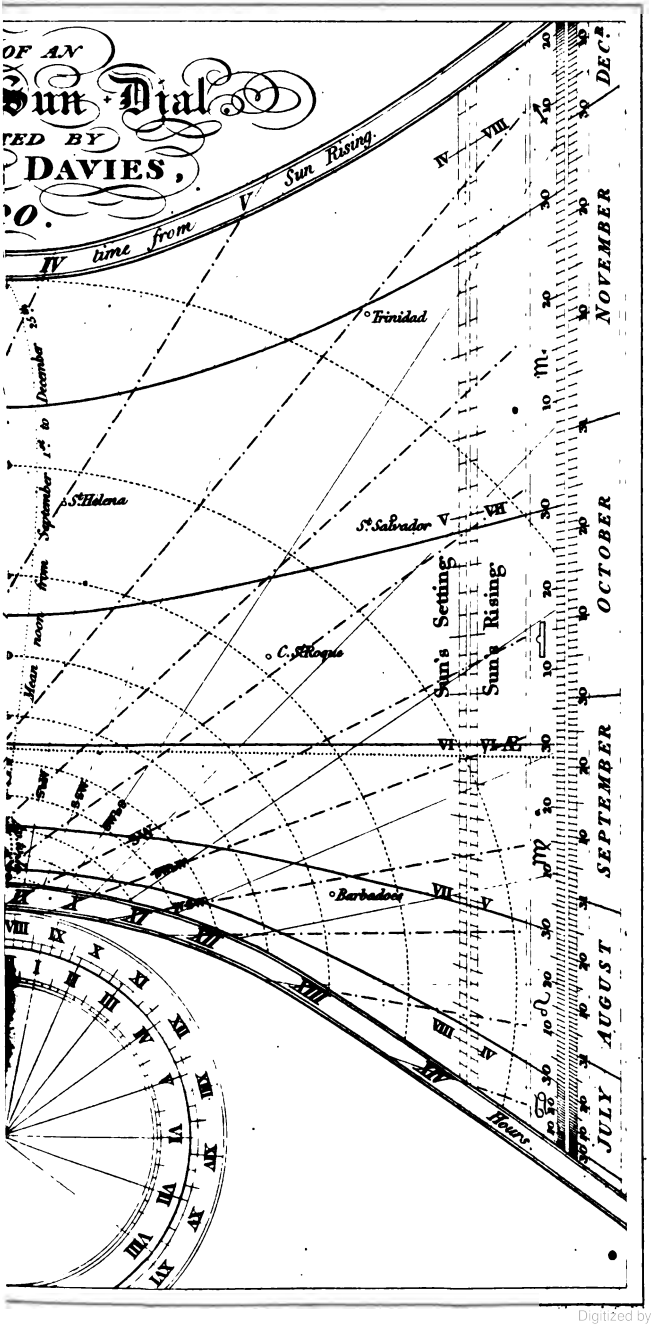

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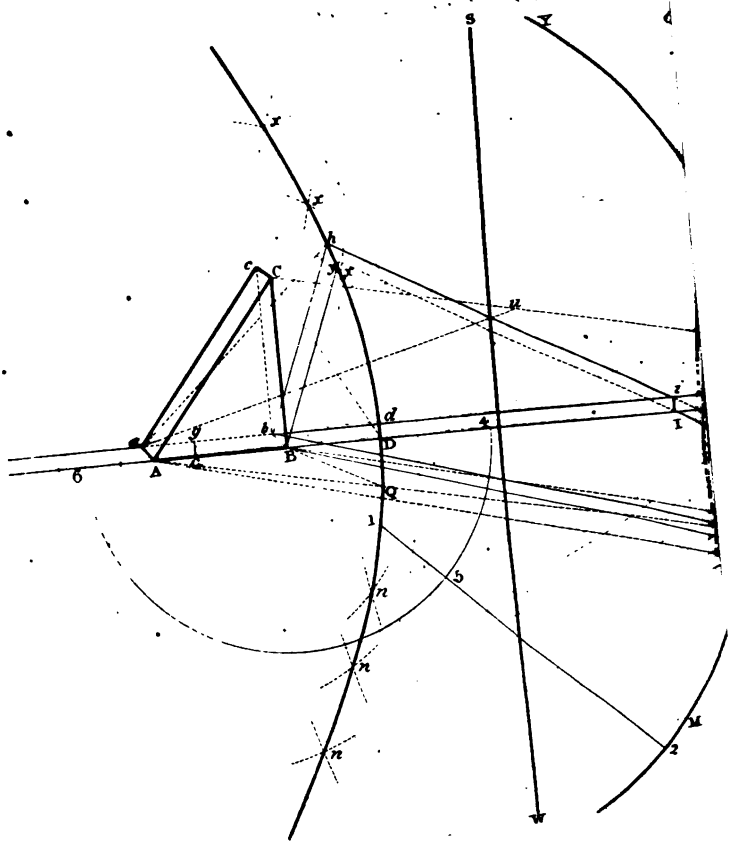

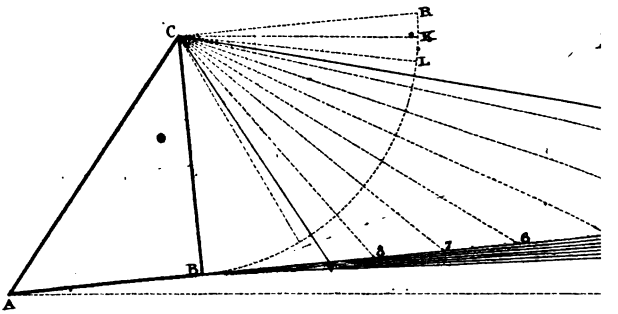

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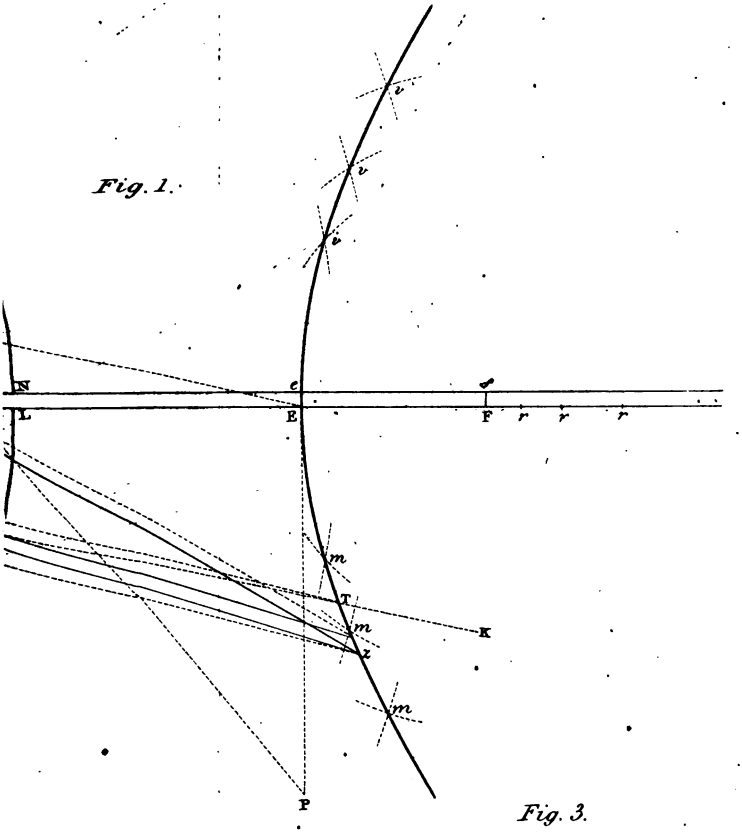
Joseph Clement, Del.

Davies's Sun Dial.

Fig. 1.



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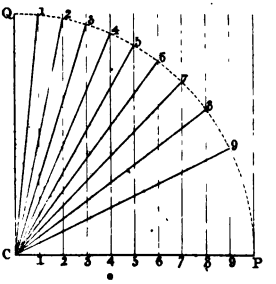

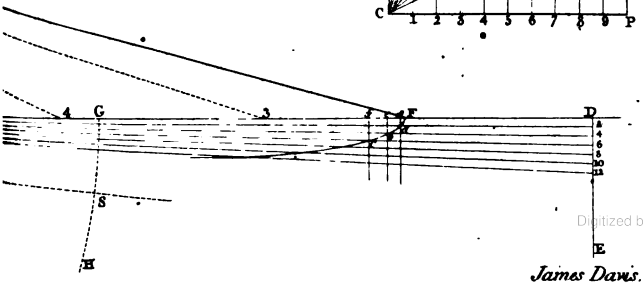

James Davis. Sculp.

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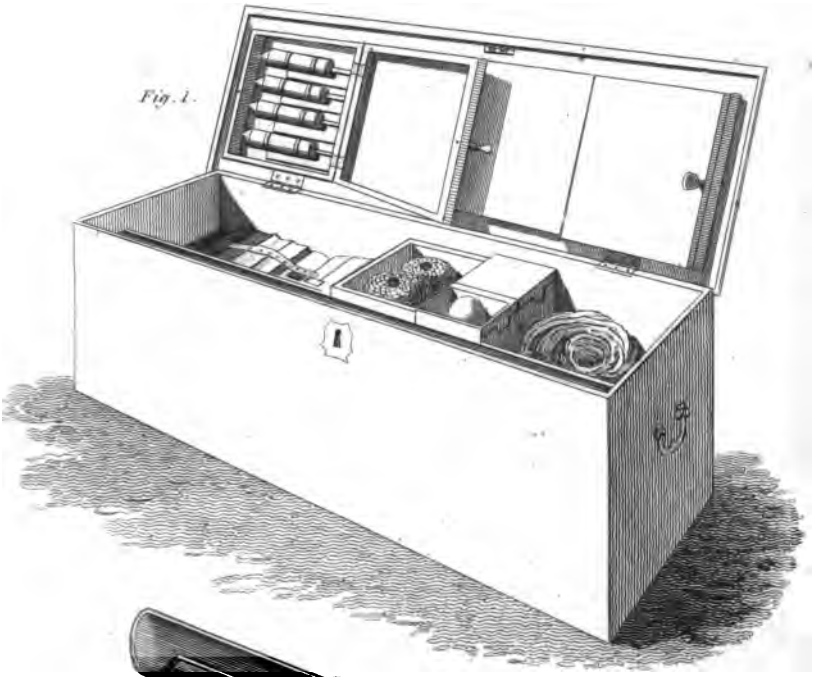
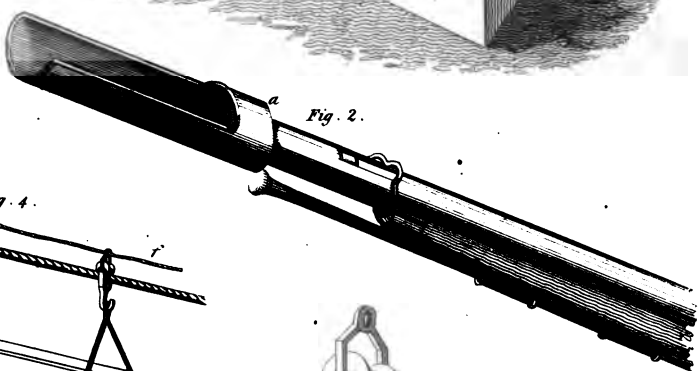
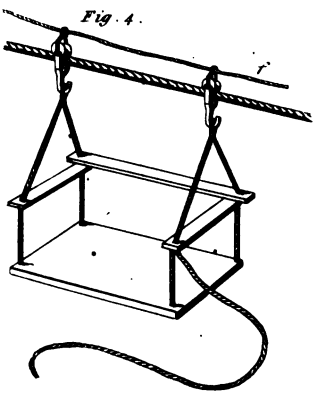
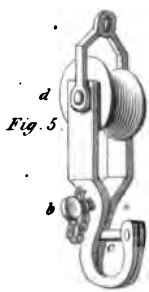
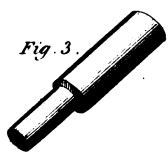
Mr. H. Trengrouse's apparatus for rescuing persons from shipwreck.

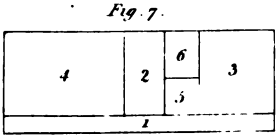


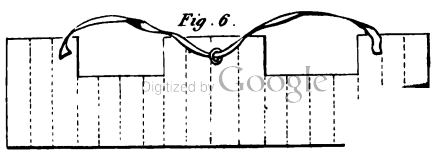












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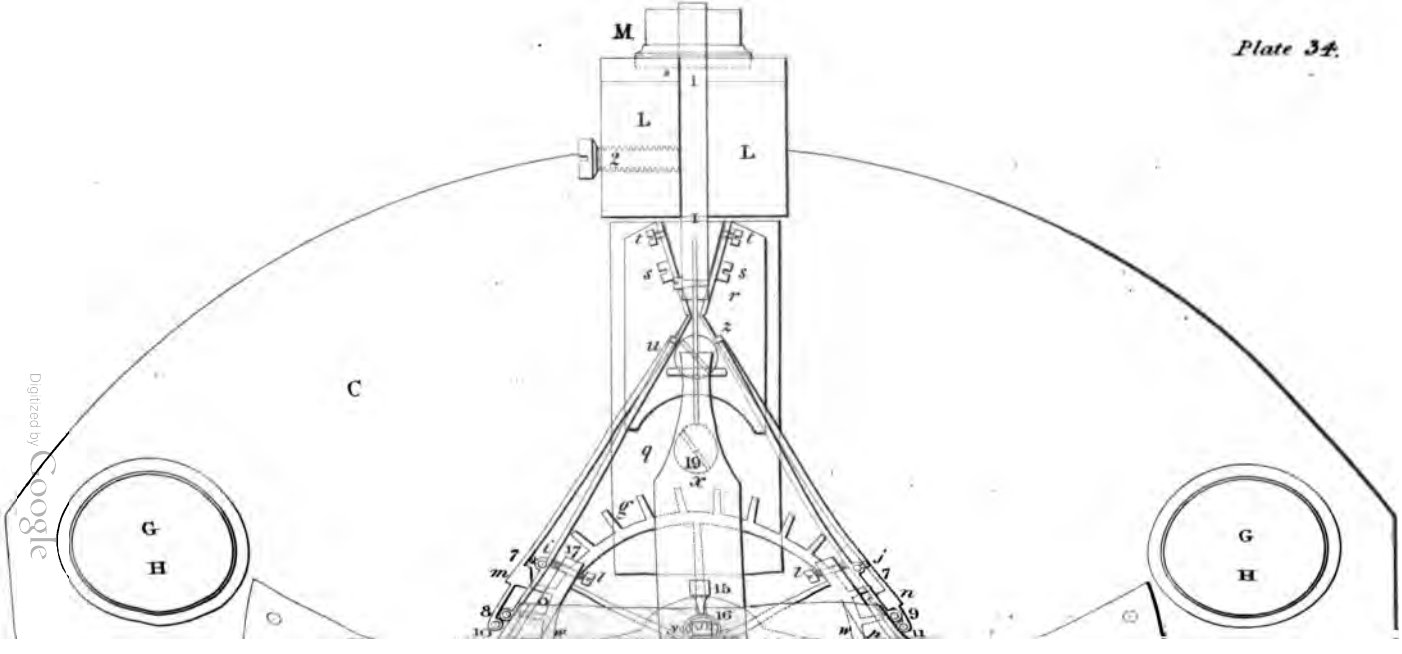
Mr. H. Hardy's Timekeeper.

Plate 34.



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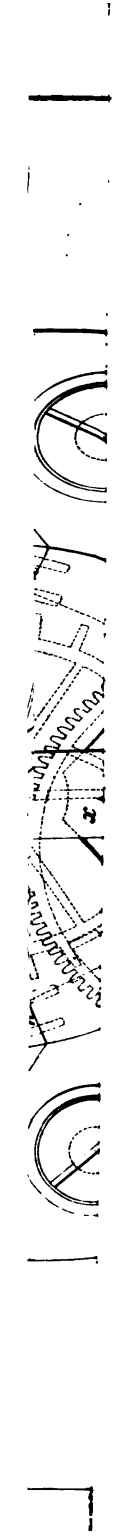

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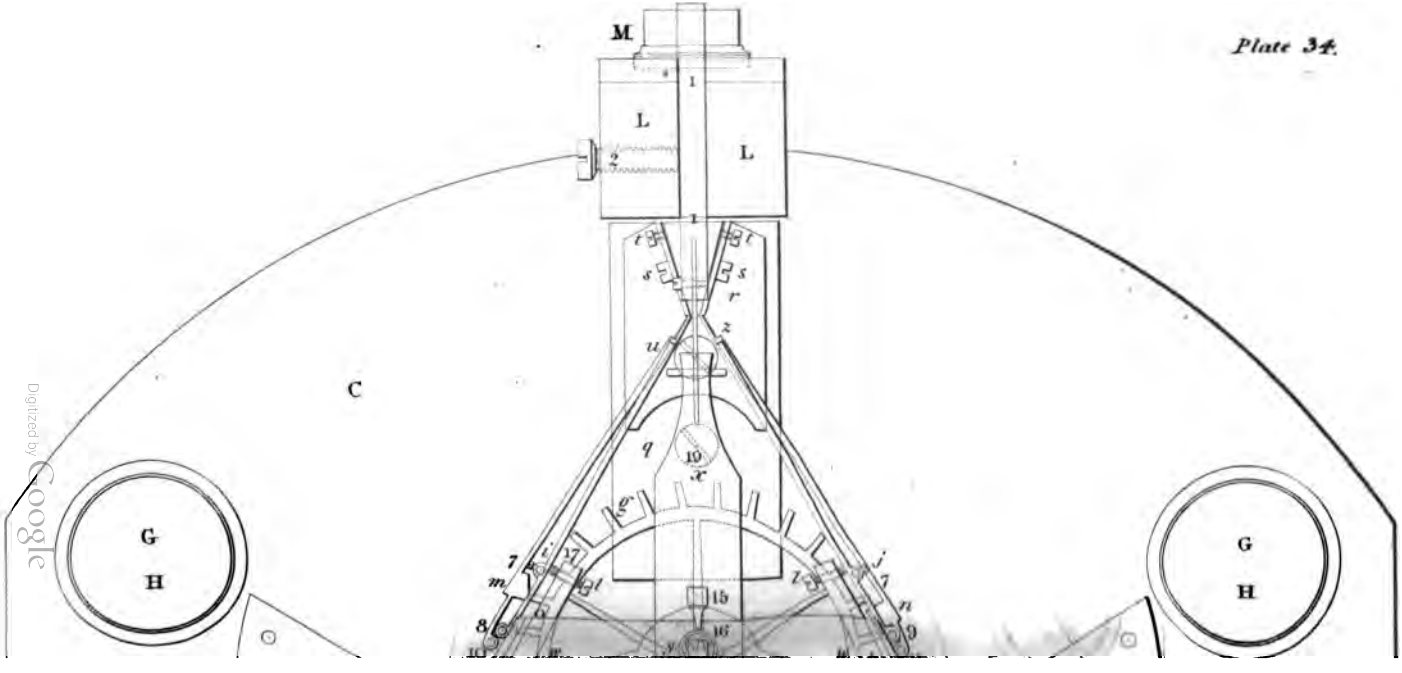
Mr. W. Hardy's Timekeeper.

Plate 34.



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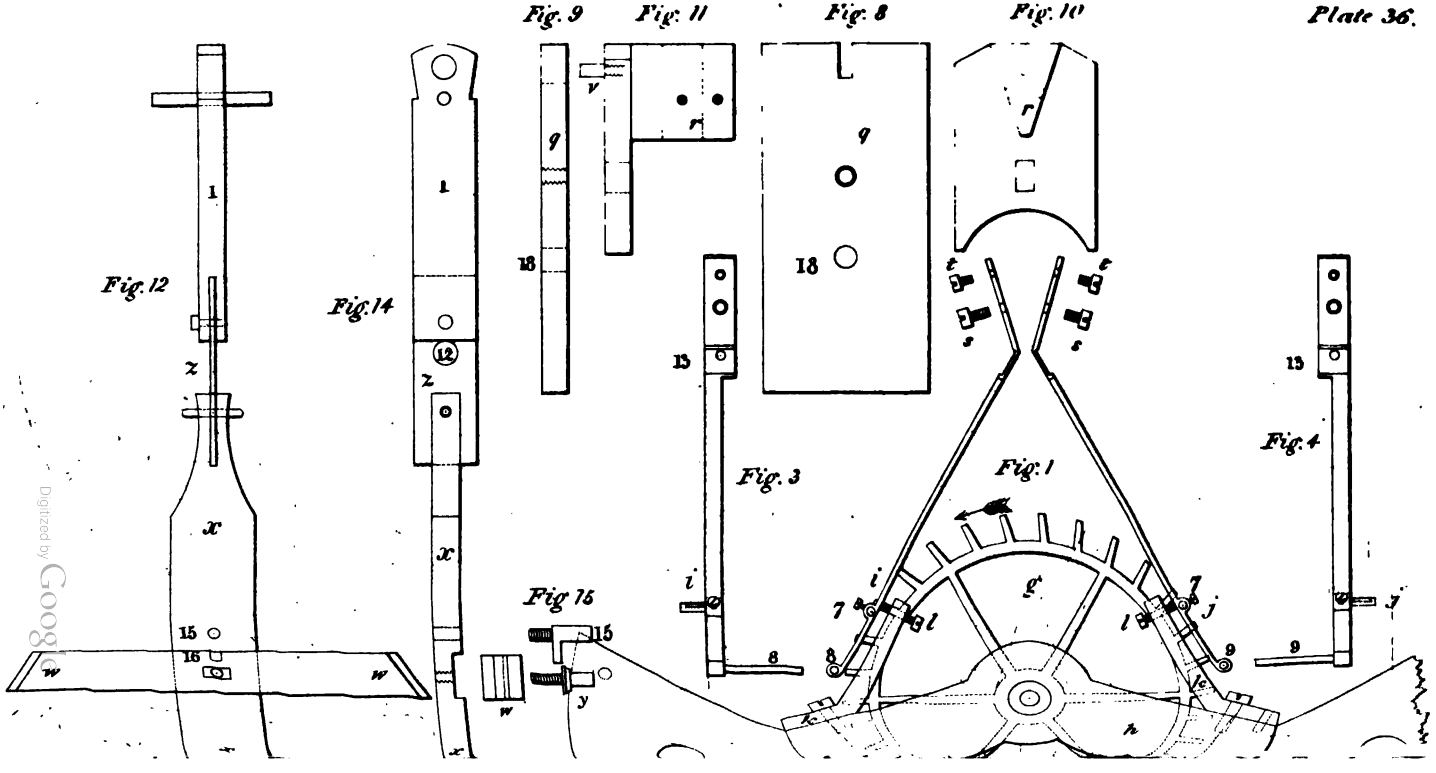
Mr. W. Hardy's Timekeeper.

Plate 36.



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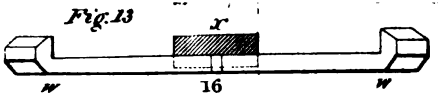

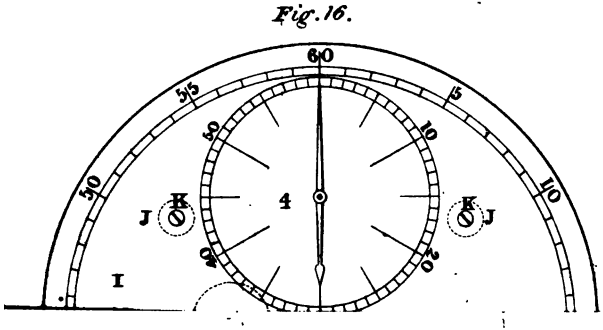

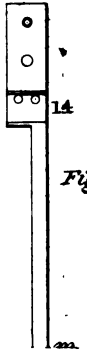

Fig 6

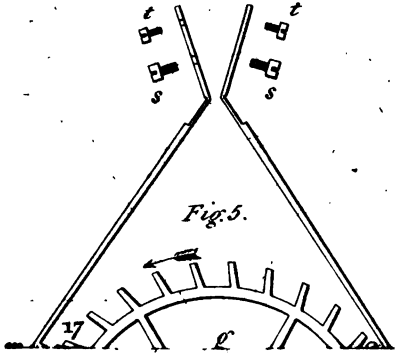

Fig. 5.

Fig. 7

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Mr W. Wardy's Timekeeper.

Plate 36.

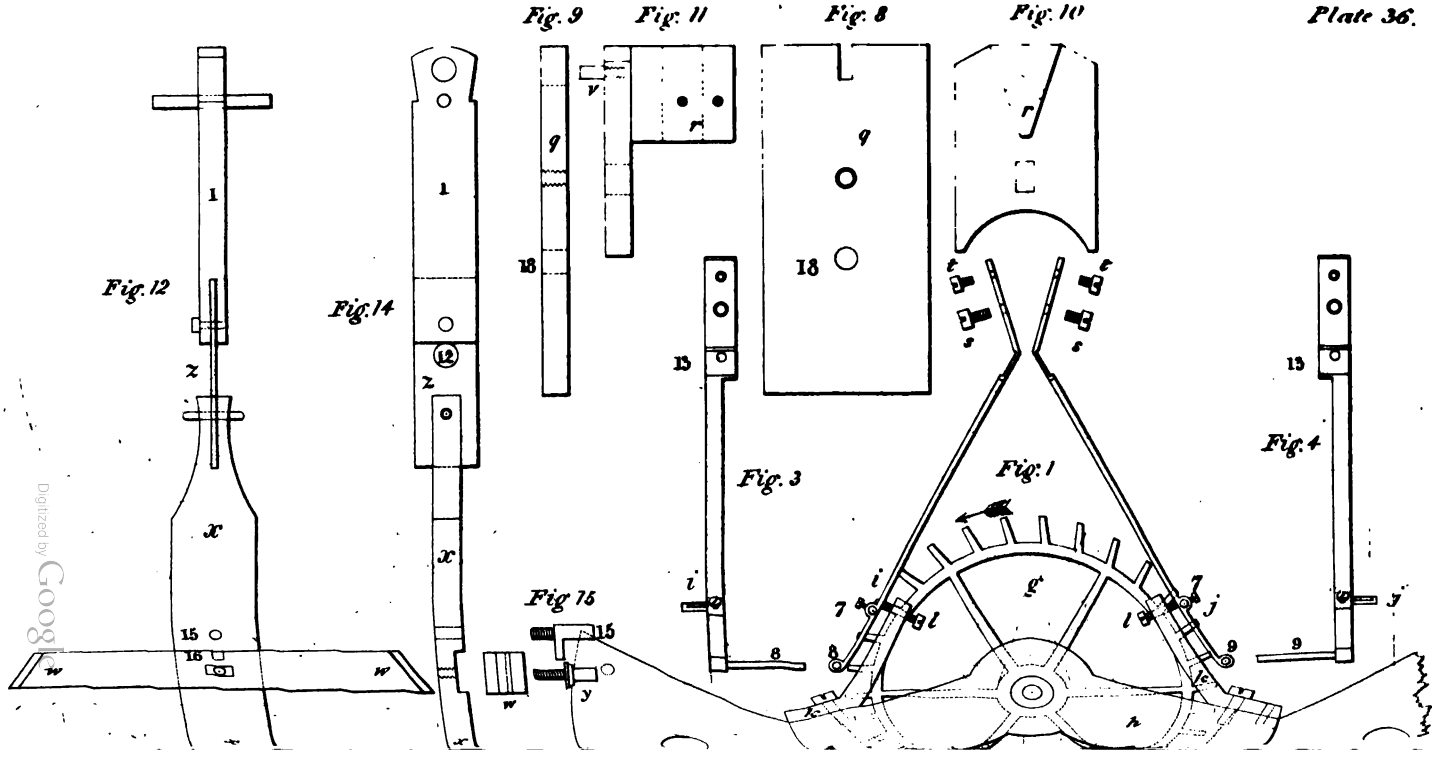

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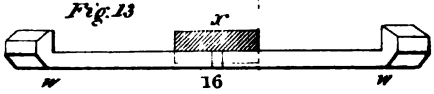
Fig. 13



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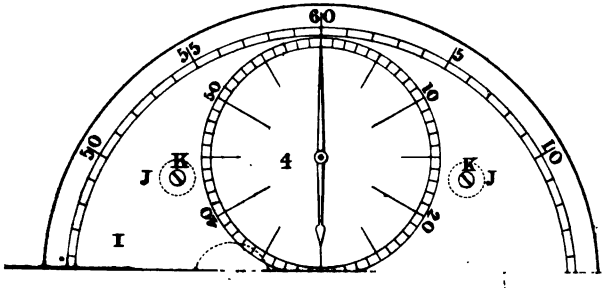

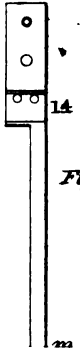

Fig 6

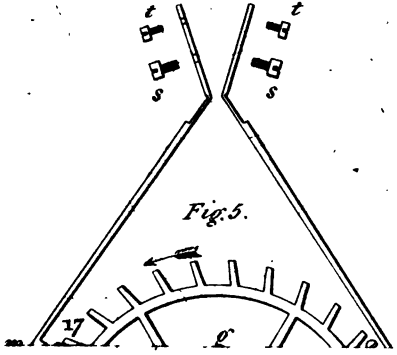

Fig. 5.

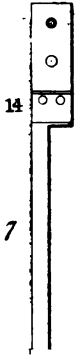

Fig. 7

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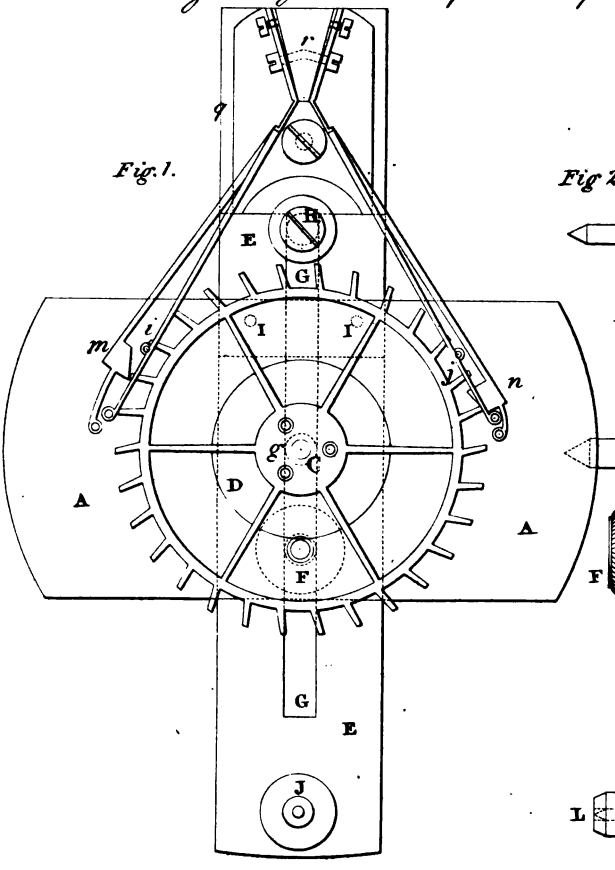
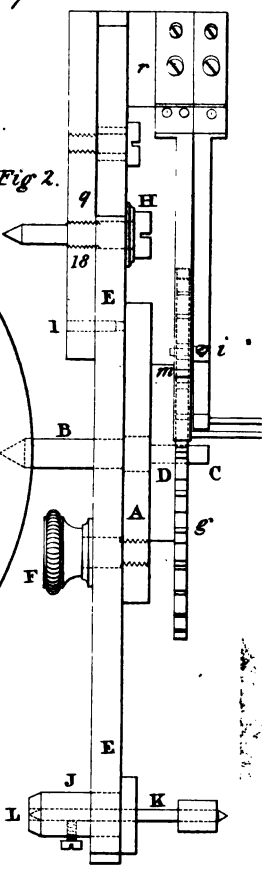
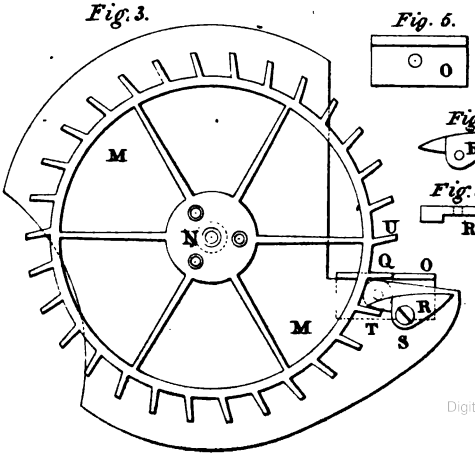
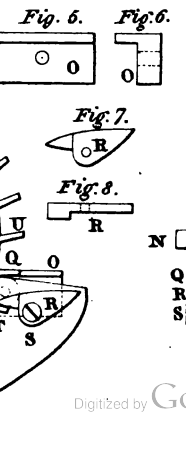
Mr. W. Hardy's Instruments for pitching the teeth of Wheels & adjusting the teeth of the Escapement Wheel.









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Mr. W. Hardy's Timekeeper.

Plate 38.

Fig. 1.

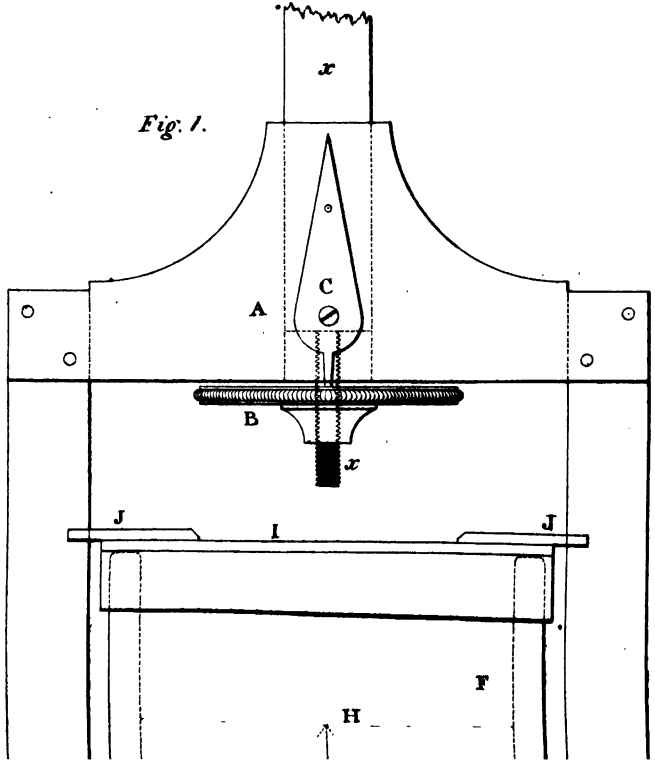
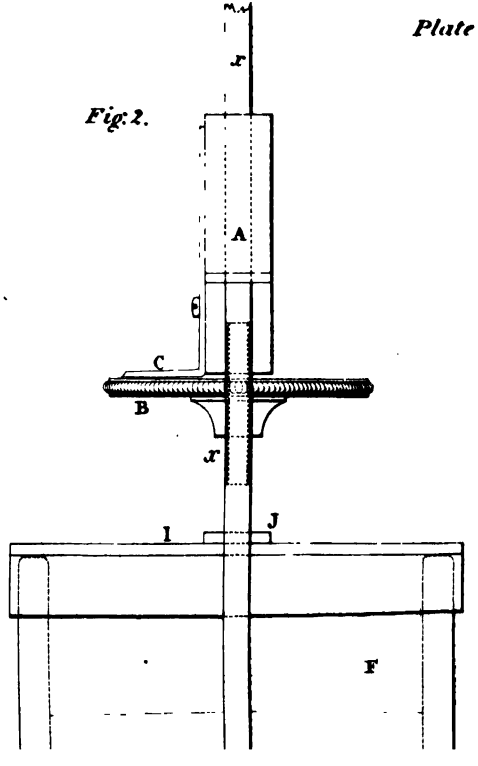


Fig. 2.



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Mr. H. Hardy's Timekeeper.

Plate 38.

Fig. 1.

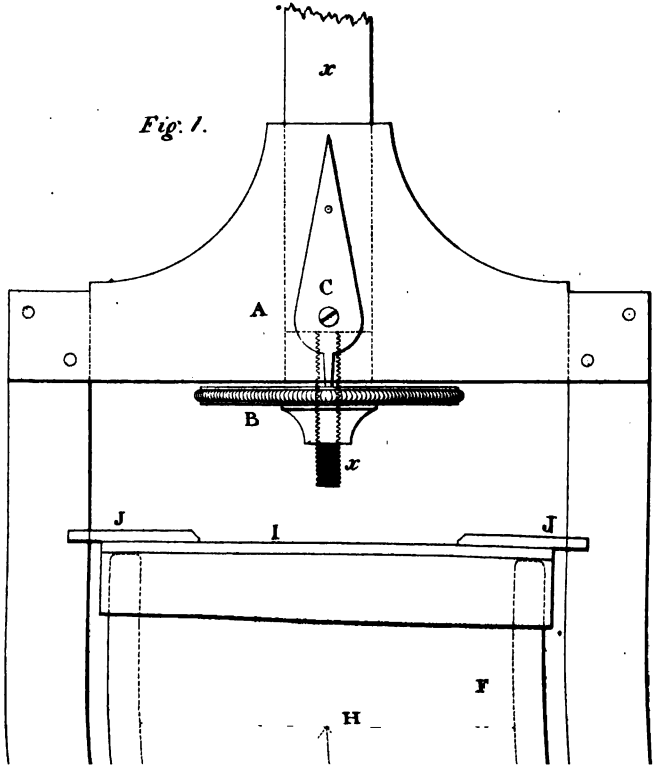
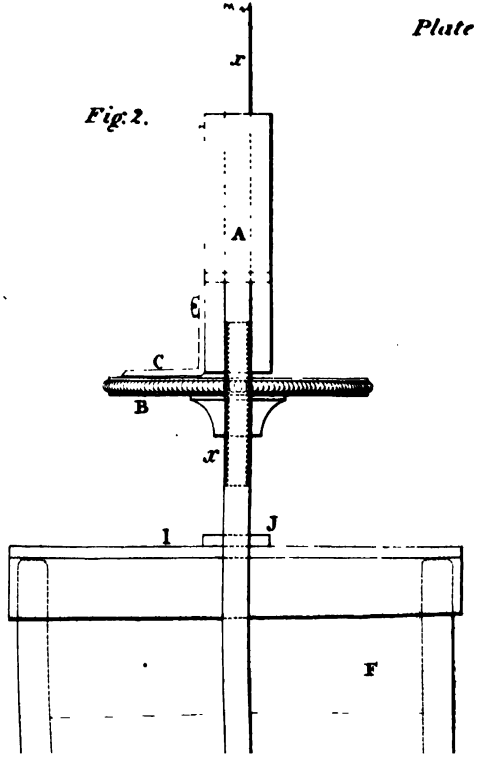


Fig. 2.



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ERRATA AND CORRIGENDA IN VOL. XXXVII.

Page 87, *line* 1, for *A*, read *C*.
—— 118, — 16, for *XVIII*, read *XIX*.
— 19, for *XIX*, read *XVIII*.
— 21, for *XIX*, read *XVIII*.
—— 123 — 11, for *inner*, read *outer*.
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—— 155, — 24, for *o*, read *O*.
—— 177, — 12 and 17, for *p*, read *q*.
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— 16, for *V V*, read *v v*.

N. B. It is recommended to detach this list of errata from the present Volume, and to place it in that to which it refers.

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